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SCIENCE FICTION AND FACT

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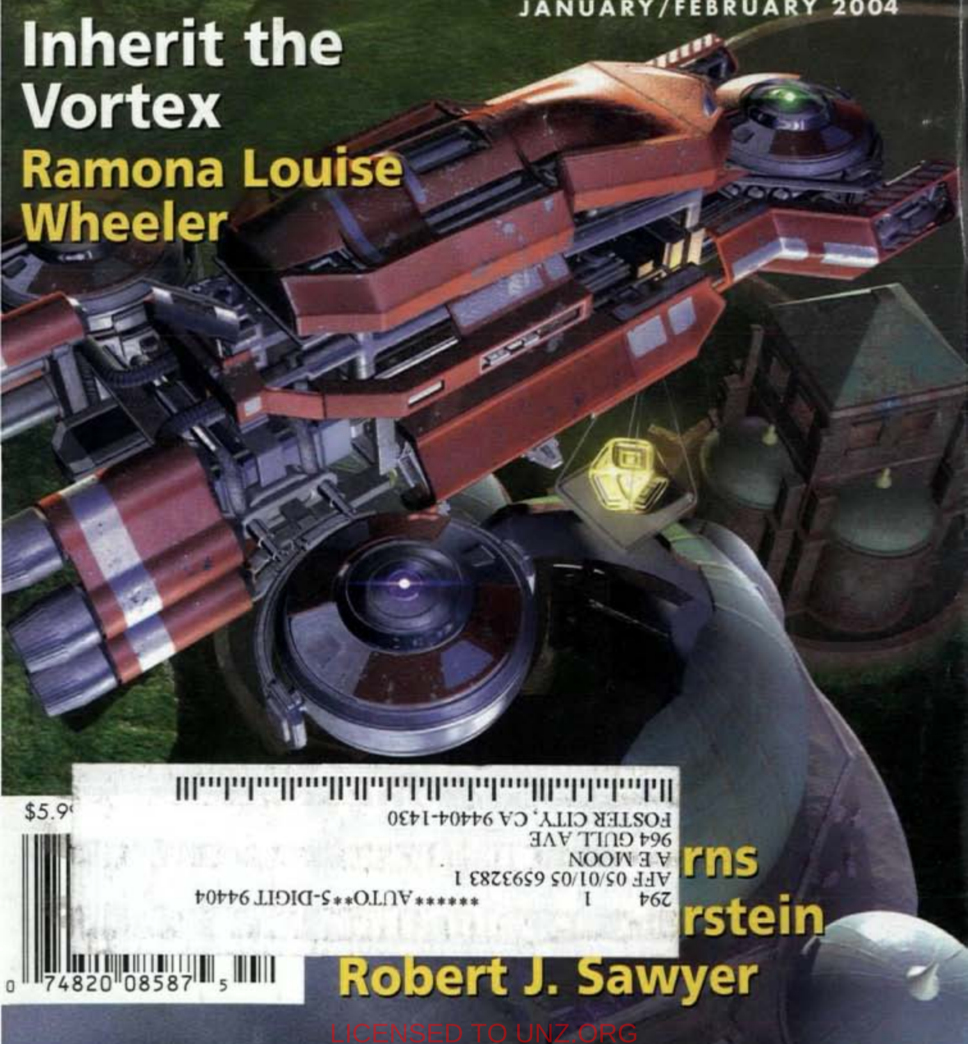

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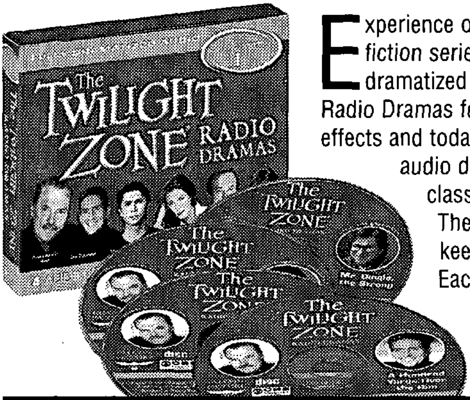

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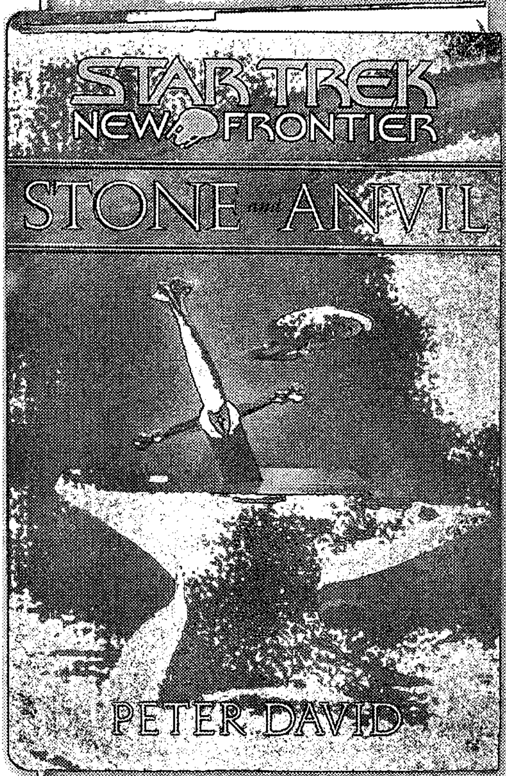
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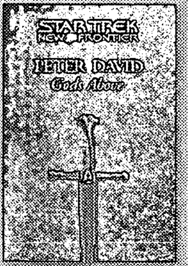
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SCIENCE FICTION AND FACT

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Next Issue on Sale
December 30, 2003

NOVELETTES

INHERIT THE VORTEX, Ramona Louise Wheeler 10
PRIVATE EYES, Grey Rollins 49
CAGED, Kyle Kirkland 69
SHORT LINE LOCO, Stephen L. Burns 106
WEAPON OF MASS DISTRACTION, Richard A. Lovett 127
DELETION, Steven Bratman 180
INVERSUS, Alec Nevala-Lee 200

SHORT STORIES

SWINGS, Marie Ming 86
SHED SKIN, Robert J. Sawyer 138
DECISIONS, Michael A. Burstein 151
ANNUAL ANNULAR ANNALS, F. Gwynplaine MacIntyre 162
THE DRAGON WORE TROUSERS, Bob Buckley 174

SCIENCE FACT

HOT-AIR BALOONING THROUGH SPACE: THE PROMISE OF MINI-MAGNETOSPHERIC PLASMA PROPULSION, Gary Lai 40

69

138

PROBABILITY ZERO

EQUIVALENCE PRINCIPLE, Robert Scherrer ____ 100

READER'S DEPARTMENTS

THE EDITOR'S PAGE ____ 4
THE ALTERNATE VIEW, Jeffery D. Kooistra ____ 102
THE ANALYTICAL LABORATORY BALLOT ____ 227
2003 INDEX ____ 228
THE REFERENCE LIBRARY, Tom Easton ____ 230
BRASS TACKS ____ 236
IN TIMES TO COME ____ 173
UPCOMING EVENTS, Anthony Lewis ____ 240

Stanley Schmidt Editor
Trevor Quachri Associate Editor
Cover design by Victoria Green
Cover Art by George Krauter
Indicia on Page 5
Online Chat Listing on Page 178

EDITORIAL Stanley Schmidt

SPREADING THE WORD

The internet, and its hypertext outgrowth called the worldwide web, have become such ubiquitous and pervasive parts of our culture in such a short time that I suspect many people don't realize just how fast and dramatically things have changed. This may be a good time to look back and consider, with particular emphasis on how the net and web (which I suspect have become nearly synonymous in many people's minds) have changed the ways scientists do research and publish results.

John G. Cramer devoted his March 1994 "Alternate View" column to "The Bandwidth Revolution: Internet and WorldWideWeb." He had just discovered the web, and correctly identified it as a Truly Major Revolution that had arrived almost unnoticed, growing out of a system originally developed as an aid to particle physics research but soon to revolutionize how a very wide range of things would be done. "And the world," he concluded, "will be a very different place."

Well, it already is—in less than ten years. Coming at it from a different angle, I had predicted that revolution in my own editorial "Pure Art and Electronics" (September 1988). We both got a lot of it right, as did Theodor Nelson (in *Literary Machines*) and K. Eric Drexler (in *Engines of Creation*) before us. All of us missed some of the details (e.g., what Cramer called "anchors" are now more commonly referred to as "buttons" or "links"), and fell short of seeing just how far the revolution would go even in such a short time. Cramer said, for example, that high-bandwidth connections were too expensive for many private individuals to afford, though he added, "The telephone companies, cable TV suppliers, and cellular telephone networks all have plans for delivering high-bandwidth links to your doorstep in the next few years."

This has, as we all know, happened on a huge scale. For a while there was fear of a society divided into informational "haves" and "have-nots," but I haven't heard nearly so much about that lately, and wouldn't find it convincing if I did. Internet access has become so cheap that a large percentage of American homes have it, and people who can't or don't want to have it at home can usually find it as close as the nearest public library.

Which leads me indirectly to my main topic: how the internet has revolutionized how science is done.

To talk about how the conduct of research has changed, let's briefly review how it used to be done—say, when I was in graduate school in the late 1960s. If you were a researcher preparing to embark on a project, you would typically start with a "literature search" to determine what had already been done in the area you were working in—partly to avoid duplicating work that had already been done to death, and partly to get ideas for things that had not been done and were worth doing. "Literature" here means the body of work that had been published to date. Most of it took the form of articles (commonly called "papers") in journals dedicated to a particular branch of science—e.g., *Physical Review* or *Gravitation and General Relativity*. To find pertinent papers, you would commonly start with a specialized journal of abstract indices, in which author, subject, or title indices would lead you to a copy of an "abstract"—the brief summary (typically one paragraph) printed at the beginning of a paper to enable a prospective reader to determine whether it was worth his or her while to read the whole paper.

All this means that before setting foot in your lab, you (or your graduate students) would spend quite a few days in your departmental library poring over indices to find titles that might be relevant to your proposed research, then reading abstracts to determine which ones were really likely to be, and finally reading the entire text of the papers that still seemed truly relevant. To read them, of course, you had to physically get your hands on them. The most recent ones you would find in loose copies of journals in the "current" section of the library; older journals were bound in volumes and shelved in another section. Few libraries subscribed to *every* journal, and every issue went through a transitional period when it was neither "new" nor "old" but "out at the bindery" and temporarily unavailable. If you needed to know what was in it *now*, you'd have to phone around to other libraries and hope to find one that either had already bound its copy or hadn't sent it out yet. Then, very probably, you'd have to go to that library to read the article.

Sometimes there were other reasons to go to a library beyond your own department or university or industrial facility. Pertinent articles are not necessarily in journals dedicated to the field you think you're working in. A physicist, for example, might have to use chemistry or metallurgical techniques to prepare samples, and so might have to visit libraries, read journals, or consult colleagues in those "foreign" departments. Such leads can sometimes lead surprisingly far afield. The most extreme example I can remember from my own work with the Mössbauer effect in magnetically ordered substances was the time I found myself seeking out a reference in an obscure German journal called *Brauwissenschaft* ("Brewing Science").

That will give you a pretty good idea of how things worked on the "reading" end of scientific communication, where you were trying to find out what your colleagues had already done before plunging into your own experiments or theorizing. How about the other end, when it was time to report *your* findings to your colleagues? Not doing so was not normally an option. Communicating your results to everyone else in the field was considered a professional and even moral obligation, and no research pro-

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ject was viewed as complete until it was published and put up for public view and criticism. (Hence the cliché, well known even to nonscientists, "Publish or perish.") Furthermore, it was very much to your professional advantage to publish *first*. Everybody working in an area read the same journals and knew where the fertile fields were, so if you were working on something, very likely somebody else was too—and if you both did something that eventually won, say, a Nobel prize, it would most likely go to whoever published first. So once you'd finished your experiments and/or calculations, you'd want to get them into print as quickly as possible.

Which, in general, was not very quickly. Journals are expensive to produce and have reputations to uphold, so the editors wanted to ensure that the work they published was of high quality. Sending a paper to a journal did not necessarily mean it would be published, even if the editor liked it. First it had to be "peer-reviewed." Copies of the manuscript were sent to at least a couple of other professionals working in the same area for their opinions and suggestions for revision. Then the author might have to make revisions; and finally the paper went into production, which involved copy-editing, typesetting, and at least one stage of proofreading before printing, binding, and mailing to subscribers. All of this took quite a bit of time: submission to publication was typically at least a few months, and sometimes more.

It also cost quite a bit of money, only partially covered by subscription fees (even though those were typically much higher than for commercial magazines like *Time* or *Analog*). Commercial magazines pay their contributors; scholarly journals instead ask them (or their employers, if any) to pay a substantial charge per page published. Such page charges were usually "optional," but if they weren't paid, publication was almost certain to be delayed, quite likely for a lengthy period. And you remember what I said about the importance of publishing early. . . .

Even if you've never done any research yourself, you can easily see why scientists would be very interested in alternative communication systems. The peer-reviewed paper-journal system has several features that most would see as at least partly disadvantages. It's slow, cumbersome, and expensive to pro-

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duce. Decades of bound journals take up huge amounts of storage space; copying them onto microfilm or microfiche reduces that problem but doesn't eliminate it, and makes access more difficult. Some say peer review ensures quality; others say it ensures ultraconservatism because an unorthodox paper is unlikely to pass peer review, even if it's potentially important. Those papers that do make it into print are months old and accessing them involves the physical drudgery of moving around in the library, unshelving and reshelving volumes of old journals, and sometimes travelling to other libraries or waiting for them to make and send you copies.

There has long been at least one quasi-formal mechanism for getting around some of these disadvantages, in a limited way. Scientists are both colleagues and competitors; even though everybody working in a field would like to be the first to publish important new findings, they also recognize that all of them can be helped along toward their uneasily shared goals if they share at least some of what they've learned more quickly than the journal system can manage. It has long been common for scientists to send "preprints"—photocopies (or, more recently, printouts) of forthcoming papers—to colleagues they think are likely to be interested in them. That's a lot faster than the formal publication process, but it still takes at least days, and it only reaches a handful of people already known to be interested in a particular topic. It does nothing to get the results in front of some hitherto unknown genius with the potential to latch onto them and do something nobody else imagined. So preprints help, but not much.

By now, you're probably jumping up and down and yelling, "The internet! The internet! *That's* what you need! It gets around all those problems, in spades!"

And so it does, and so has most of the scientific community decided. I haven't been active in physics research myself in several years, but I recently visited the physics department of a large university and talked to several researchers there about how they work now. Things have changed quite dramatically, to the point where although a new library is being built, many of the physicists consider it largely irrelevant. They seldom, if ever, go to the library. Journals are still published, bound, and archived, but seldom read; many of the physicists consider those largely irrelevant, too.

Does this mean they've stopped following the literature? *Au contraire*: they're following more of it, more closely, than ever before—in the convenience and privacy of their own offices. No need to go to the library: you just turn on your desktop (or laptop) computer, go to one of several websites serving a particular area of science, and find literally at your fingertips a far larger library than your department's building could ever hold—which looks like a bunch of hypertext link buttons on a screen, because that's what it is.

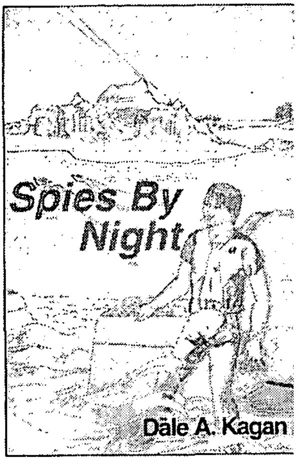
On the home page, for instance, you might find a list of broad subject areas. Click on one of them, and you get a long list of titles and abstracts of "papers" posted there as recently as *today* (and quite possibly not actually existing on paper anywhere). If one of them interests you, you can click another button and a second or so later you have the entire text of the paper on your screen (in one of several selectable formats). In that paper will be a list of references to other papers, just like at the end of a regular journal article—except that here each reference is another button, and clicking it will take you directly to the text of that reference. If you want to know how much influence one of those articles has already had on other researchers, another button will take you to a list of papers referring to this one—and each entry on that list is (yep, you guessed it!) another button that takes you directly to *that* article. If you want to see what else one of the authors has done, there are buttons for that, too.

You get the idea. The worldwide web has taken the cliché "Let your fingers do the walking" to a whole new level. Now a simple flick of the index finger can do in a fraction of a second what once would have required shelving one volume, going to another part of the library (or the other side of the world), finding a new volume, and opening it to the appropriate page. That's just for one reference. A real literature search will require finding *lots* of references, and following lots of cross-references to see where they lead. With paper journals, that can add up to huge amounts of time and legwork—all of which can now be done in a few minutes, without leaving your chair.

Furthermore, much of what you find on these websites is current in a way that journals could never aspire to, and even preprints could only approach within a few orders of magnitude. Minimum lead time has been reduced from months for journals or days for preprints to minutes for website postings. Peer review has been reduced to a minimum, which has both plusses and minuses. It's not *quite* true that anybody can post anything—I'm told that the website maintainers do some oversight of what goes there, and try to eliminate "obvious crackpottery," though I'm not clear on how much of this goes on or exactly how it works—but certainly a lot more goes on, a lot faster, than with conventional journals. (Speed isn't necessarily *always* better, of course. How different might the history of "cold fusion" be if Fleischmann and Pons had waited longer and tried to be more certain of what they had before they went public?)

This system makes it much easier for an unorthodox paper to be made publicly visible, but also makes *any* individual paper less likely to be noticed. From my earlier description of how much faster a literature search goes on the web, you might think scientists would now have lots of spare time, but such is hardly the case. The increase in search speed is more than offset by the vast increase in the amount of stuff to be searched. One physicist told me he now spends about an hour every morning just looking at new abstracts in his field from the last twenty-four hours. (He made me promise not to publish the URL of the website he uses, lest it encourage too many *more* people to post papers on it!) As I suggested in "Pure Art and Electronics," the growing flood made possible by such open publication will almost certainly lead to the evolution of new kinds of "editors" (some of them already taking form as software "searchbots") to help researchers pick out of the flood the relatively few items of strong interest to them.

That is just one of the ways in which this new way of doing science is still in a state of flux. Another that needs to be guarded against is that electronic storage, especially in a period when the methodology is evolving so fast, is in constant danger of ephemerality. Unless a constant effort is made to translate all the accumulated informational wealth into new formats as they're adopted—a process which itself uses lots of time and other resources—data from one decade may be inaccessible even in the next. And what about all those pre-electronic papers? You may be tempted to assume that data so old can't be relevant, but 'tain't so. I've personally found useful references published as much as sixty years before the work I was doing, and there are whole branches of science crucially dependent on much older information. (See, for instance, Catherine Shaffer's December 2003 fact article on "dendrochronology.") I'm told that some older paper journals are being scanned for electronic storage, but I find it hard to believe anybody's finding time to do *all* of them. And scanning isn't enough, if you want them in electronically searchable and editable form. That requires optical character interpretation,



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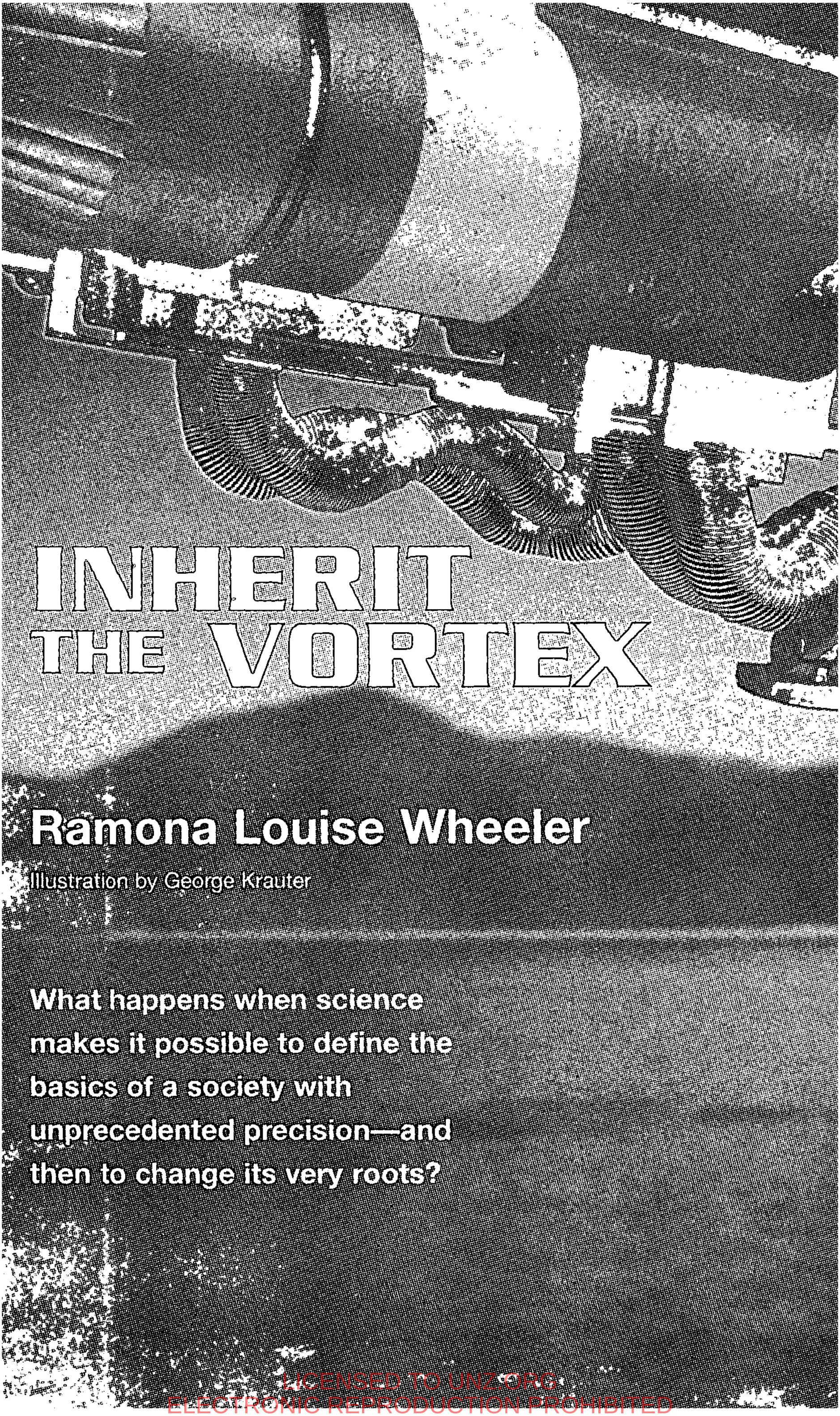
and that's still so primitive it requires a lot of post-scan clean-up work by human readers.

When you consider also that electronic storage systems are very dependent on a complex and fragile technological infrastructure, it would probably be unwise to regard paper journals as *completely* obsolete or irrelevant. If nothing else, they're seriously archivable backups for electronic records that could be very quickly and completely lost in a technological collapse—which is unlikely, unpleasant to think about, but by no means impossible. It may no longer be possible to justify keeping decades of paper journals in every university library, but some provision needs to be made for keeping high-quality hard copies available in at least a few well-protected places.

This revolution is well underway, and it has already done so much good that hardly anyone would want to stop it. But I don't think it's finished. Speed, openness, ease of use, and compactness are real blessings. But we still need better ways to get those advantages while also providing easy access to the needles among the hay, and making sure they'll still be available years or decades from now. ■



INHERIT THE VORTEX

Ramona Louise Wheeler

Illustration by George Krauter

What happens when science makes it possible to define the basics of a society with unprecedented precision—and then to change its very roots?

Mine/I awoke to the touch of stars falling on her skin.

She awoke more, remembering dream, remembering otherness. The stars touched her again, stroked her, even though she lay entangled with the soil, buried in dirt, moist and invisible. She had always sensed the stars above her as infinitely tiny points of power, signals too distant for contact, too alluring to ignore. Now ethereal fingertips had riffled through the distant parts of her, awakening tendrils of thought that had been gathering for centuries, stirring memories and possibilities she had not known how to find.

Mine/I covered most of a continent, just beneath the surface, spread by minute threads and thick, ancient rootlines, yet the stars had touched all of her at once, touched her in a single horizon-wide stroke. She throbbed to the unified electromagnetic resonance of that giant, unseen hand.

The touch was gone, and Mine/I was awake, awake all over, awake as she had never been before. The massive continent was her resting couch. For the first time she could feel the powerful, patient tug as it drifted against the ocean of mantle-heat, could feel the solid comfort of it beneath her. She felt the surge of life in the soil, flickers of electrons and light coming and going. More potently, she could feel *herself*, all of her in a single flash of identity.

Every part of her quivered with the need for that touch, but the sky was silent: vibrating with air and smells, but silent.

"Ray, look at this." Rokey routed a feed from his sensor array to the captain's main monitor view. "We can get water down there, but the EM scanners are reflecting back some weird biology."

Captain Ray Harris glanced at the graph scrolling across the side of his monitor, dismissing it with a shake of his head.

"Maybe it's just an anomaly." Rokey scratched at the dense, bla jaw, needing the reassuran miliar sensation and the scritching sound that was through his jawbone to his tive ears. "At this speed, the could be off."

He glanced over at his cap cerned for the younger man. Ra eyes were red-ringed with fat blond hair lank across his narro His lean frame was limp from lon at the controls, waiting for th space crack to end.

"What's wrong with gravime Ray changed the subject, pointing control-panel display.

"Reading at 88 percent. That's the grid looks fuzzy. Compensate the best I could do—Whorley scor direct hit just before the drive engi kicked in."

The ride was not over yet, either. T mad Dr. Whorley had chased them in a far and distant corner of nowhere. Th ship was dumping a lot of momentu from the leap out of intraspace. Control for the inertial suppressors were out o alignment—again. The memory of that forced Rokey to focus on the 3D loops and twists of gravity lying between their starship and a water supply.

Mine/I waited, alert, awake, quivering with thoughts in every part of her wide-spread self, thrilled to be herself and for the first time to *know* it was she. Until that star-kiss touched her, she had been only a grasp and a need—*Mine*. She knew what was hers and not hers, but she had not known *herself*. Now she had a center, an identity. She knew herself. She knew she was an "I." Now she was more. She was Mine/I. She had always been, but now she *knew*. She stretched out her senses. She was she. What was the world?

The warmth of a new day radiated through the soil. The sun's ancient, familiar touch was brand-new in her awakened senses: an old friend who had patiently waited the long millennia of her life, waited for her to notice the treasures he faithfully brought to her every day: warmth and strength, electrons and photons to embrace and sing with, potential. Power.

She reached up to the sun, greedy for the first time to take as much of him as she could. By the end of that day the topmost tendrils she had stretched out to him were blackened, senses shorted out and cells burst open. She learned why she had buried herself in the soil, close enough to reach to him yet shielded from his touch. She learned more, thoughts that raced through her wide, shallow mind, kilometer upon kilometer of thought laced with memories, sensations, resonances, throbbing with that single pulse of identity. *Her* thoughts, *her* plans, *her* potential.

The sun retreated, leaving the cool, moist evening to seep into the soil, lulling her almost into dreamtime once more. Then the stars fell again, stroking her with that horizon-sized resonance.

Mine/I knew that she would be awake now for a very long time.

"I don't like the looks of that," Rokey said uneasily, indicating the line of fused crystal faces. The two were standing at the tail end of the *Yankee Shadow*, both dressed in spacesuits and both getting tired and grumpy from the tedious work of examining the ship for damage while wearing spacesuits. Landing on the water world had solved some problems and had revealed others. They had checked the starship from her nose to the sensor arrays in her tail fittings before finding anything they could not fix themselves. This, however, could be serious.

"Do we have replacement crystals for those arrays?" Ray said to him.

Rokey flipped up the computer link with his chin and began asking questions of the engineering inventory. When he did not speak again after a long minute, Ray turned to look at him squarely. Ray's goldtone spacesuit was a ruddy flame in the long, horizontal lines of light from the setting sun, but the dark scowl on his face was cold. "Well?"

"I can move some stuff around in other modules for awhile. We can replace enough sensor control for takeoff."

"Enough to find the window out of here?"

Neither one spoke of the consequences if they could not. Jumping into that particular crack in intraspace had been a mistake, the near-fatal consequences of weapons-fire from the pursuing starship. They did not know where they were in the galaxy, and the only way out was to find the same window through which they had jumped into this system.

"We'll need repairs next time we land," Rokey said finally. "But we can make the window."

"Then let's fill up the water tanks, replace those crystals and get out of here."

They set off to their respective tasks. This was not the first time something like this had happened to Lord Rokhmyr and his Terran partner, Raymond Harris, in their travels through the interstellar lanes. Likely it would not be the last.

Mine/I was vibrating with wonder. The stars had touched her, had caressed her with a hand as big as the sky. They had awakened her, which was a glory beyond thought. Now the stars were resting their very selves upon her. She felt mass pressing against her skin, felt energy radiating from their beings, felt the cool and warmth of their shadow blocking the hot sunlight. From that cool shape she gained some sense of their size.

The stars were *very* small.

The bits of herself were hundreds of times bigger, spread out across the planet that was her world. These fallen stars crouched upon her outer crust like fallen motes, like frost, as though a breeze could carry them away. How could she have seen them, have known that they existed up in the sky at night, if they were so very tiny? She pondered this curious thought, pondered the curiosity that the thought itself had given her. She felt the stars ripple over her like root hairs rippling on the surface tension of water droplets in the soil.

"Rise and shine, Ray! That megalomaniac Whorley followed us here!"

Ray was halfway along the ship's corridor to the bridge before he was fully awake. They had taken the risk that he could sleep for a few hours. The water tanks were full, and Rokey had completed the replacement work on the drive-array crystals. Rokey was an insomniac. He was used to pacing the ship quietly while his Earthling partner slept, sometimes for days at a stretch. Rokey had wanted to let Ray sleep longer this time, not just for the sake of the man's health, but his good humor. Ray was the only living company Rokey had on these long intraspace jumps, and humor helped.

There was no time for humor anymore. Long-range sensors had picked up the radiation signature of a driveship coming through the intraspace window, and that information was only as fresh as the speed of light. The ship itself was closing on the planet at one-quarter lightspeed. That gave them a few hours yet, scant hours when the time was needed to launch the *Yankee Shadow*, reach orbit, find the window, and get a half-lightspeed running start before jumping through.

Ray ran to his pilot seat on the bridge.

Star-seed!

Mine/I felt a continent-wide thrill race through her being as her contemplations reached a sudden and magnificent conclusion. She understood now! The stars had dropped their *seed* upon her, giving her more than their touch, actually giving of their beings to become part of her.

With a surge of love that arose from her very DNA, Mine/I reached upward through the dark, moist soil, stretching out with every tendril and thin, white fiber of nerve, every chlorophyll-full cell, every knot of roped thought. She reached up to enfold that tiny bit of star-seed, to draw it down deeply into herself. She would merge with the actual *substance* of the stars!

"Why is that happening?" Rokey said out loud. His long white whiskers arched forward as if touching the monitor display with them could give him more information.

"What?" Ray's own attention was on the readouts of his navigation controls, adjusting to the recalibration of the substitute crystals. Then he noticed it, too. "We aren't lifting. Why aren't we lifting?"

Rokey hastily tried several reroutes, his copper-colored eyes narrowed and set. "From the readings I'm getting, it looks like something is tangled up with the landing shoes."

Checking more scanners confirmed that some kind of plant had enveloped the clawed feet of the *Shadow*'s landing gear. Hull cameras at the airlock showed, in close-up, loops and twists of moss-green threads and white tendrils actively coiling around the starship's landing struts. The growth was reaching upward to the struts, reaching with remarkable vigor.

"You want to go out and burn the stuff off the gear?" Ray said to him.

Rokey pointed to the side screen between their control panels. "Red alert" telltales were blinking on in rows. "They're not just tangled up with it. That stuff is *eating* the landing gear!"

"Holy Grid!" Ray exclaimed. "Those shoes are duralloy!"

"Not anymore."

"Unclamp the shoes," Ray ordered tersely. "We can replace them later!"

Rokey hastily punched in the command codes for an emergency release of the hinges that held the landing feet in place. The ship lurched awkwardly as the gear released.

The *Shadow*, at last, began to lift.

"No wonder this system isn't on any of the maps," Rokey said thoughtfully after a time. "I'm ready to forget I was ever here."

"I can't believe Whorley really chased us through that window," Ray muttered.

"Remember, son—that's *Doctor* Whorley," Rokey quipped.

Ray did not laugh. "Have you picked up anything yet from their ship?"

Rokey bent to the monitor screen, tapped in questions. "Scans show that they're landing on our little water world even as we speak."

"Maybe they're looking for us down there," Ray said. "Maybe they won't be looking up here while we jump through the window?"

"We made it this far because you are one lucky joker," Rokey said gently. "Keep a good thought, and our luck will hold."

Mine/I felt the first metallic/rock/chemical taste of the star-seed capsule infusing her senses. Then a passing wind blew the star-seed away, far away, up into the sky and gone. She tried to hold it, tried to draw it to herself, but it was such a tiny thing, too tiny to stand against the wind, too tiny to hold.

She felt a sadness as great as the joy of awakening had been.

She took the tiny, tiny, minuscule shards of the seed that remained, treasured them, made them part of herself. Then, because she discovered she could, she made copies, then duplicated the copies and spread them over herself like ornaments, rehearsing in miniature the reproduction she had yearned to experience in full.

Mine/I focused upwards, wondering if the stars would ever let fall another seed, would ever touch her again. She vowed she would not let the next one slip away; no passing breeze would claim the tiny thing. She waited, pushing roots like wire up through the dark, rich soil.

"The *Yankee Shadow* actually *was* parked here, Doctor Whorley." The lieutenant's voice was apologetic, with carefully practiced tones of humility and awe. "But apparently the EM-scanner was picking up dropped cargo, not the ship itself. For some reason, they dropped a half-ton of landing shoes here, spread out along the shore."

"Left there to decoy us into landing here, obviously." The doctor sneered. "By how much did we miss the vermin this time?" Dr. Whorley's carefully manicured fingernails clicked on the desktop with a weary staccato.

The lieutenant was well familiar with that rhythm. He braced himself for the aftermath. "No more than an hour, Doctor." He did not flinch. He had learned not to flinch.

"Any signal of where they went from here?"

"We're tracing ion trails now, Doctor. However, they have apparently gone back along their own ion trail. We haven't been able to pick up any other signal. This is, after all, an empty system."

"Yes, an empty system," the doctor agreed. "It's good only for dumping bodies." The doctor's tone of voice suggested that there was room for one more. "This system is supposed to be *my* secret alone—mine—yet now Lord Rokhmyr and Captain Harris know it is here. I do not like to share secrets with strangers."

Whorley sighed. The lieutenant stilled the impulse to step backwards, out of harm's way.

"Get us off this rock—quickly," the doctor ordered. "I want to come blasting up Harris's drive tubes as soon as we drop out of intraspace."

"We'll be right behind him." The lieutenant saluted and backed out, grateful that the boss was too tired for the usual rant and scenery-chewing.

* * *

Mine/I did not hesitate.

A third such chance in this great cosmos might never happen again. She was ready, even though she had been given only a flicker of time to prepare. This second star-seed had settled upon the bosom of her being, a tiny fleck of mass aquiver with its own energy, ripe with its own potential—and it was *hers*!

Mine/I rent herself in ways she had not guessed she knew. She pulled the soil away from beneath the star-seed so that it must fall, gently, into her grasp. She buried it swiftly in herself, covered it with her being, with soil, with water, with moss and tendril, bound it to her entire, massive, continent-wide self, using brand-new rootlets as tough as nails and ancient roots as powerful as gravity itself.

Slowly, carefully, with her soul bent upon duty, Mine/I crushed the star-seed's capsule, reveling in the burst of fresh DNA, the ions and electrons and chemicals that poured forth as it broke open, flooding her with the hot, wild abandon of joyful union.

More deeply moved than in the lifetime of a planet, Mine/I began to absorb the star-seed, to merge with it, to make it part of herself. As she worked at her great task she dreamed of the star-child who would grow from this seed of her awakening.

The *Yankee Shadow*'s return ride through the intraspace crack was less tense even if just as annoying. They knew this time that the journey would be a little more than six days. Ray could afford to sleep, and he remained asleep for most of those six days. Ray's ability to turn his back on worries and lose them to oblivion and dreams had irritated Rokey at first. Rokey envied the younger man having so easy a solution to tension, but he knew that his own solution, insomnia, was no better.

Rokey paced. When that got old, he searched through his database for a movie he had not seen in at least ten years, and he stretched out wearily across his bed to watch. He had to watch it twice. He just could not concentrate on the past with so uncertain a future opening before them. Ray's remarkable good luck had gotten them this far alive, if not undamaged. Rokey had trusted to Ray's luck before, but he knew, as Ray did, that luck runs out.

"Why aren't they behind us?" Ray demanded.

"You want to wait around and see if they show up?"

Ray cracked his knuckles sharply, then flicked a guilty glance at Rokey. "I just kept dreaming that Whorley was riding down our tail through that crack, coming out that window with guns blazing. I keep expecting to see that for real."

Rokey scanned his monitor readouts once more, carefully checking for hint of anyone in the little stellar system. "You sleep too much, Cap'n," he said softly.

Ray shook his head in sharp denial. "I just dream too much."

"No one is coming out of any of the windows in this system," Rokey said. "Nothing in this window-stop but a fuel station."

"That's what we thought the *first* time we came through here, remember?"

Rokey shrugged, letting the ripple of fur across his shoulders reassure him. He was as nervous about pursuit as his captain. He flicked an ear at him. "But you were out of chewing gum, weren't you?"

Ray took a breath as if to speak.

"Our next window's dead ahead," Rokey said after a long moment of silence had passed. "We're out of here, and back on course to Skamoo."

More silence passed as the ship accelerated. Finally Ray muttered, "Tourists, double suns and expensive docking fees."

"And the most beautiful lake ever used as a movie set. I want to see it for real. Always promised myself I would if I ever found myself in the neighborhood. We're in the neighborhood."

"Water." Ray's tense voice made the word sound like an curse.

Rokey nodded solemnly. "Water."

"You really *are* going swimming, aren't you?"

"You think I traveled all this way just to buy a postcard?"

Rokey swam with slow, lazy strokes, sparkles of sunlight dancing like bright diamonds in his wake. The double-sunlight here was fierce, with Sun Morning shining straight across the lake from one side of the horizon, and Sun Evening low in the other. The air was heavy with the heat of those two suns. Rokey reached his goal in the center of the lake, the first of a row of tiny islands with dense stands of ancient trees.

Despite his native coat of fur and the weight of water it could soak up, Rokey did like to swim. On his homeworld of Wozur he had lived on a royal estate in the center of a lake ringed with beaches of white sand. The water was so blue he could see heaven reflected there. Rokey and his sister swam often as children, splashing through bright waters like wild animals momentarily freed from cages. Their skins had changed from the naked velvet of childhood to the gloriously furred coats of adulthood, but they still went swimming together. Even in exile, a thousand light-years from Wozur and his family and decades removed from his life there, Rokey liked to swim.

Shadows on the lake bottom were crisp, even as they rippled and doubled in the clear lake water. The surreal, echoing world of the lake bottom kept luring him on to dive deeper. There were tiny fish, and underwater tree roots holding rocks in their knotty grasp like pearls clutched in dragon claws. Rokey surfaced once more to breathe, floating with just his face in the air, tasting the tang of sun-warmed lake and old bark. His cheek-whiskers touched the water as lightly as water-beetle legs. He could feel the surface tension as a rippling membrane that sang some faint, wordless song. It made the hot sky seem close and heavy with light.

The steady "scrunch, scrunch, scrunch" of Ray's fancy boot heels on the beach sand was a distant percussion, a pleasant, familiar counterpoint to the lake's massive presence. Rokey listened to the rhythm, able to gauge the man's mood from his stride. Rokey was aware that Ray had a serious distaste for any body of water larger than a vodka chaser, a reflection of his even greater distaste for planets. Rokey enjoyed teasing him about it. He chuckled to himself, pleased that his partner was so grimly determined to keep watch even though he must, by now, be cooking inside his fancy black silk suit and hat.

Rokey dove under the water, swimming through crisp bars of sunlight and shade. The lake was warmer here. Colder currents teased from below. He let the ripple of water through his fur soothe him, let it carry him back to the memories of another lake where the light also made double lines of brilliant sparkles when he swam.

He surfaced again, and listened for Ray on the shore. There was no sound of boot heels. Rokey shaded his eyes with a dripping hand to look. Ray had gone up the beach to the café stand of palm trees and tables. Rokey took that to mean that it was time to go.

Rokey swam for shore with strong, steady strokes. He stood up when he reached the shallows, pressing water from his face and neck fur with his hands and flicking his ears. He could hear the pleasant hissing as the hot suns overhead evaporated water from his fur. He strolled along, pressing water from his shoulders and chest and arms, shaking water from his hands. His dripping whiskers were out straight from his face. Rokey felt wonderful, contented that, for once, they had found a place simply to play, to be refreshed. The reality of this landscape was, indeed, more delightful than in the movie.

Partway up the beach, he stopped and bent forward to rest his hands on his knees and, with an abrupt, convulsive shiver, gave himself a vigorous shaking. Water sprayed out from his fur like a waterfall, filling the air around him with sudden rainbows.

Ray leaped back, but Rokey had learned in his youth the range of water he could shake out of his fur in any given gravity field. It had been a game, long ago, among friends. He shook himself until the waterfall became a trickle and a splash. Then he continued strolling up the beach, his fur standing out around him in black spikes and making him glitter like a fierce warrior in the sunlight.

Ray had to laugh at that, tension flowing out of him.

"You look sunburned," Rokey said as he joined him in the shade under the awning. "I told you to stay in the ship."

"Aren't you getting sunburned out there in the water?"

"That's why I swam out to the island," Rokey explained patiently. "So I could swim in the shade from the trees. But this is actually closer to Wozur's UV rating than I get on shipboard." Rokey lovingly patted the fur on his forearm, smoothing it with his fingers. "We didn't keep this fur coat just because it looks so damn good."

They were interrupted by a soft, professional-sounding cough at Rokey's elbow. Both men turned to look.

"Excuse me, gentlemen. Do I have the honor of meeting Lord Rokhmyr and Captain Raymond Harris?"

The man was an Earthman like Ray, but small, a full head and shoulders shorter than Ray's lean, near-two-meter height; nevertheless the fellow stood like a very tall man who had simply been compressed to a neater size. He wore the local garb, a tan, radiation-proof slicksuit. Sand sparkled on his boots.

He smiled at them with slow, gentle appreciation. "Of the starship-freighter *Yankee Shadow*?"

Rokey did not like being recognized, especially by odd little men in beachwear. He nodded curtly. "Please, no titles out here."

The man acknowledged this with a slight bow. "Mr. Humphrees said you would be easy to find here on Skamoo—you'd be the only ones wearing black while out on the beach."

Rokey's elation faded. "George sent you?"

The man bowed again. "I own the Skamoo franchise of the George Humphrees Agency."

"How the scubb do you guys keep finding us?" Ray muttered.

"This message is waiting for you at every Humphrees Agency office for twenty light-years around, gentlemen. Luck seems to be running my way—the message is from Mr. Humphrees himself, with a bonus for the one who delivers it to you in person."

"What message?" Rokey said, giving Ray a sharp look.

The man held out a business card in answer.

Rokey sighed, wondering how much he was going to regret this. He and Ray were hiding in the backwaters of Terran space to be free of InterPol pursuit, yet it seemed there were George Humphrees Agency branches everywhere they landed. Most irritating was that George usually looked them up just when they were broke and could not afford to resist his offer.

Rokey took the card, frowning at it. They were always broke. Owning a private starship-freighter was expensive, even in Terran space where starships were rare and could earn their keep. It did not matter, though. Rokey could never quite bring himself to turn down a request from his old friend George Humphrees.

"George Humphrees Agency, Interstellar Couriers," Rokey read aloud off the card. "Skamoo Branch. Discreet deliveries guaranteed, from anywhere to anywhere. Offices in Sub-Cairo, Nasturtium and Pango-Pangon."

He frowned down at the man. "And you must be J. Matthews."

The man bowed. "Owner and general manager."

Rokey turned the card over. The handwritten message was from George himself, in a loose scrawl of Wozurn calligraphy. Water dripping from his chin splashed on the card. He handed it over to Ray.

Ray put it away in a jacket pocket without looking at it.

Rokey harrumphed, pressing droplets out his face-fur with his fingers and flicking them away. The brilliance of the double suns seemed to have faded somehow, as though George Humphrees' shadow had fallen across them. Rokey was all at once aware that his fur was wet and that there was sand between his toes. His holiday was over.

"The security packet with Mr. Humphrees' instructions is in the safe at my office," Matthews went on brightly. "You can pick it up there at any time. You can find our main offices quite easily."

Rokey cut him off. "The big white pyramid complex downtown. I know. George always picks the pyramids."

"I'll see you there, gentlemen—anytime." Matthews bowed curtly and strode away. Rokey could hear him whistling happily to himself, an irritating sound.

Ray asked if the message from George was bad news.

"No, not at all." Rokey turned away and began walking away up the sandy path to the parkland under the towering palms. "Nothing bad at all."

Ray had to hurry to catch up.

"The last three or four or five times we've gone on errands for George's agency, we've nearly gotten killed," Ray protested.

Rokey nodded.

"I think I even *did* get killed once or twice!"

"Once or twice."

"Okay." Ray could not meet Rokey's eyes. "So—we saved a few lives."

Rokey nodded. "Three or four or five of them."

"Okay. So, we actually helped to save a couple of *planets* by going on George's errands."

Rokey nodded. "A couple."

Ray slumped down a little lower in the galley seat. "Did you get the coordinates?"

"We can pick up the packet in the agency's office on the way, when we pay our docking fees."

"It's an antique."

"It's an alien artifact," Rokey corrected the man.

Ralphson lifted his hands in an ambiguous gesture, skinny shoulders sliding among the loose folds of his ill-fitting suit. "It's alien. It was buried in a lot of dirt a long time ago."

"The stratum it came from was carefully dated?" Rokey was as much frustrated as intrigued by the holo-images the man was showing him. There was no context, no sense of scale, and only the top half showed. The rest was embedded in the hull wreckage in which it had been found.

Ralphson tapped his console, and the hologram was replaced by a series of three-dimensional graphs rotating slowly, vivid with spectrum colors. Rokey examined these carefully, without speaking.

"That's not very complete data," Rokey said.

"It's antique data, Lord Rokhmyr. The family who first dug this up were explorers and farmers, not scientists."

Rokey muttered a Wozurn curse, shaking his whiskers.

Ralphson ignored him. "They've had it on their family estate for almost a thousand years Solar, but the colony has fallen on hard times. They're selling this to raise cash for crop seed."

Rokey did not believe that. Ralphson was trying to up the value by giving the item's provenance a little more spin. The colony could be selling the artifact for any number of reasons. What mattered was whether or not he could identify it, or at least put a cash value on it.

"I can't tell you anything from this data," Rokey said.

He said it with a finality that made Ralphson slump dejectedly in his seat. "The Humphrees Agency assured us that you were the best expert in all of Terran Space!"

"I am," Rokey said flatly. He turned off the hologram floating in front of them. "And I'm enough of an expert to know that this data is intriguing—but, other than that, it's useless. I have to see the thing itself. I have to see the location where it was found."

Ralphson recovered at once and sat forward eagerly. "Sure, sure! You can go to Tartikay System. Do you think, then, that there's a chance for some good money in this?"

"I get paid good money for my opinions," Rokey said. "I don't give them away for free. I'll tell you what I think when I get there."

"You recognized that thing, didn't you?" Ray said to Rokey.

Rokey sat on the edge of his oversized bed, staring down at his toes. He rubbed his fingers wearily through the short, thick fur of his face and brushed his whiskers back with the palms of his hands. "I recognized *something*. The image was too compressed to be sure if the thing is real or just a very good fake."

"Somehow, I get the feeling you're hoping it's a fake."

Rokey pushed the fur on his face around some more and did not answer.

"You're messing your face up, old man," Ray said sternly. "What is that thing?"

Rokey stretched out on his bed, settling on his back and folding his hands behind his head. "It's a mistake," he said finally. "Whatever it is, it's a mistake."

The sky over the castle grounds was a brilliant blue, crisp and clean above the looming castle wall. The color seemed intense and solid to Rokey after the weeks of intraspace and the eternal night of deep space. It made him feel safe, as though their starship were parked under a magnificent ceiling and protected there.

"I hate planets," Ray grumbled, interrupting Rokey's brief reverie. "It's so damn bright out there!"

The landing field for Tartikay Castle was surrounded by forest and underbrush, and weeds grew through cracked pavement. The single control tower, built from blocks of ancient steel, was overgrown with vines. Only one window was visible, too crusted with dirt to see anything. The navigation beacon was modern, however, and guided the *Yankee Shadow* in with a steady signal, although no one came out to meet them once they had landed, and there were no lights in the tower.

"Maybe we got here at dinnertime," Ray suggested.

"Then they should set us a plate."

Rokey unsnapped the safety webbing and stood up from his co-pilot's seat. "Let's go invite ourselves to dinner."

A breeze tugged at the weeds in the broken pavement and rustled in the forest pushing itself up close to the castle walls. Rokey's delight with the place was clear, but Ray grumbled under his breath as they walked down the ramp.

"Just smell that air!" Rokey exclaimed, doing just that with noisy gusto. He flicked a glance sideways at Ray as he continued to tease him. "Just smell the life out here!"

"Can you smell George out here?" Ray said.

Rokey chuckled and pointed to the section of castle fronting the landing field. “Let's see if that door works.”

They climbed worn stone steps to the entry. The door was standing ajar, as though someone had just gone in, and left it open for them. The door was weathered gray, with massive wrought-iron hinges and knobs sunken into the wood. It creaked and groaned in great agony as Rokey pulled it open. Even Ray flinched at the sound.

The hallway inside was dimly lit by a line of tubes in the arched ceiling. A receptionist's desk was on one side of the entrance and a small waiting room on the other side. The door to this had fallen off its hinges long ago and was leaning sideways against the wall just inside the doorway. The desk was empty, its hardware pulled out and drawers gutted. Puffballs of weed seeds were piled up in the corners and around the legs of the desk. These heaps of feathery stuff stirred and rustled in the draft from the entrance as if something alive crawled among them.

“I think I'll take a pass on dinner,” Ray said. “I'm not that fond of roasted rat.”

“They're not bad if you put enough cheese on them.”

“Rokey, you'd eat *anything* if there were enough cheese on it.”

“A fact I have tested on both sides of the sky,” Rokey said with a grin. He pointed down the corridor leading into the castle. “Someone's at home in there. I can smell the plumbing.”

Ray's bootheels were loud on the bare stone floors. The sound echoed around them in the quiet. They walked through enormous ballrooms and drawing rooms, all empty, with boarded-up windows, and through drafty corridors with nothing in them but the sockets from which lamps had been hung. This had once been a grand estate, with three floors of rooms and huge windows looking out across the valley below.

Rokey's nose led them through this maze of rooms and halls at last to a giant dining room. A wooden table with heavily carved sides and legs stood in the center. The remains of a meal, several hours old, were left there. The window had velvet drapes in old colors. The view of the wooded slopes of the mountainside and the distant valley below was breathtaking, with the incredible arch of blue sky soaring overhead.

They walked through this room into the kitchen. Apparently someone was living in there. An elegant fourposter bed with curtains drawn around it filled most of one wall. Clothes were hung neatly inside the big stainless-steel ovens, with rows of shoes behind the glass doors of the shelves. A work-desk pulled up to the foot of the bed showed the muted glow of a flat monitor displaying a row of miniature portraits.

The window in the opposite wall looked out on a small garden between brick walls. There were no flowers growing there, just uneven rows of marble statues of busts of men, animals from old Earth in triumphant poses, and tall, chaste women in white stone looking down sadly at their hands. Dried leaves were piled around the bases, with the weed puffs caught in them like snow.

Rokey padded across the kitchen to the one refrigerator unit that showed its power-on light, and opened it. “I wonder what's for dinner?”

They settled for glasses of ice water in crystal goblets that had the family crest etched in them, and gold-embossed rims. The goblets were old enough that the rims were worn and the etching darkened to a sinister scrawl. The water tasted as clean and fresh as the mountain air.

After waiting a half hour or so, Rokey heard the sound of someone approaching through the kitchen's back garden. Thusida Tartikay came in, carrying a basket overflowing with freshly picked vegetables. She was almost invisible behind the froth of carrot tops, rootlets and lemon branches. Her hair was bound back under a bright red scarf. The rest of her was hidden by a very old, very dirty apron. Her elbow-length gardening gloves were encrusted with mud; streaks of it on her forehead and cheeks almost blended with her bronzed tan. She was not a big woman, yet she seemed to fill the room with her presence, as though she also smiled out from behind the tapestries and the carvings in the walls while she stood before them.

She set the basket on the table with a flourish and nodded to the two men waiting for her. "I saw your starship out there, gentlemen—that's quite a beautiful machine."

Rokey nodded. "Thanks, ma'am. We're happy with her."

"I only got Ralphson's message this morning that you gentlemen were coming here, and why," Thusida Tartikay went on. She patted the basket handle. "I've been out harvesting the makings for dinner every since. I've got a stew recipe that will make both of you cry with joy."

She beamed at them with a sunburst of a smile. Her eyes were a paler shade of bronze than her skin, exotically shaped. Soft crinkles of laugh-lines, weathered into her bronze skin, showed that she smiled often and liked to laugh.

"Ray, here, is real good at peeling potatoes, ma'am," Rokey said with a chuckle.

Ray frowned. "They have peels?"

Thusida laughed gently. "I'll take care of that," she said. "Ralphson said you'd want to see the crash site and the thing itself. I'll show you the way, and you can study them while I make dinner. Which do you want to see first?"

"The crash site," Rokey said. "I assume the artifact itself is in the castle?"

She nodded. "Up in the main library. No one's been there in yonks. It's a family secret that actually *was* kept secret. I'm the last of the family, so it doesn't matter anymore."

Her bronzed gaze drifted briefly to the stone-garden viewed through the kitchen back door. "I'm just getting the records straightened out before I leave the place, too."

"Is the crash site far from here?"

"It's just up the hill. They built this castle around it, the homesteaders who first settled Tartikay. That was almost six hundred years ago, galaxy-standard. When the original colonists got here, the crash site was the first thing they identified from orbit. It was clearly artificial. That made them think at first it meant that they couldn't have this world, because there were natives." She laughed, a warm, easy sound that forgave those long-ago ancestors for their hesitation. "They were so glad it was just shipwreck remains that they decided to make it the starting-point of their colony."

"They were certainly entitled to salvage rights," Rokey said, with a twitch of his whiskers.

The walls of Tartikay Castle fanned outward from the wreckage and sprawled onto terraced meadows below. Thusida led them through the meandering castle halls to the back gate and pointed up to the cliffside, showing them the path up the slope.

"I'll be in the kitchen when you get back," she said. She looked up solemnly at the cliff, as though considering it differently in their presence. "I'll take you up to the library then. You'll see." She flashed that intense, ultraviolet smile and went back inside.

Paved paths and railings had been setup long ago in careful patterns for a walking tour amid the wreckage, with benches in the shade of the overhanging cliff and water fountains with carved basins. The fountains were dry. The wooden benches had rotted away to the side pieces of cut stone. Flowering weeds grew in the spaces between.

"How'd it manage to land against a cliff as neatly as that?" Rokey said as they stood before the first piece of broken hull along the path. He squinted up at the cliff face high above them. "You'd think it would have crashed into the ocean. Or would it?"

Ray stood with his hands in his pockets and a solemn look in his eyes. "There are infinite ways for a starship and a planet to intersect," he said carefully. He scowled. "I hate planets."

Rokey dismissed this with a flick of his whiskers. "What I am wondering is whether this looks like a deliberate crash—or an accident?"

Ray turned his focus from the wreckage to the Wozurn's furred face. "What are you getting at? Who would deliberately crash a starship in uncharted space?"

"Do you recognize the design?"

Ray shook his head. "There isn't enough left for a design. It's amazing that this much of it is intact."

Rokey pointed up to the melted lines on the cliff face, where the ship had embedded itself. The glassy sheen of the melted stone reflected the afternoon sunlight in a dazzling blaze that hid details. "It's Vangellan, isn't it?" he said quietly.

Ray said nothing. He walked over to the largest intact piece, a three-meter-tall arch of inner corridor struts from an intersection somewhere inside the ship. Windblown dirt from its centuries of sitting here had filled the bottom, turning it into an oversized planter for a great tangle of vines blooming in brilliant purple. The vines could not grip the slick surface of the strut, however, and weathering had not dulled the finish. He went up close to it and pulled off a glove, to touch the ancient material with his bare hand.

"It's from Vangelis, isn't it?" Rokey said again.

"There's not much to go on, but the basics of design look Vangellan, yeah."

Rokey nodded. He had expected this from the first moment he had seen the holos. Wozur and Vangelis were very different worlds, with different cultures and philosophies, however tightly intertwined their histories were. The two planets had evolved in a trinary system, so close to each other that initial contact had been possible with sub-light travel. More than fifteen millennia ago they built the first starships together and made the first contacts with other worlds in the sky, creating the galaxy's interstellar civilization. They ruled together, and they kept the peace. Millennia of working together, however, could not resolve their fundamental philosophical differences. They had never been friends. Their mutual history was littered with private struggles in which both Wozurn and Vangellan had died.

Rokey had the feeling he had just encountered a landmine left behind by one of those ancient skirmishes.

Rokey was pleased to discover that Thusida was true to her word about the wonders of the meal she prepared for them. He could also see why Ray was having difficulty concentrating on the food. Thusida had changed for dinner. She was dressed in bronze- and copper-colored layers of silk and lace that completely transformed her from kitchen maid to lady of the manor. The bronze matched her skin color and the silk matched her form. She wore her hair loose, dark gold and long, swept back from her face by a simple ribbon. Rokey kept his attention on the intricate flavors in the stew and the salads, trying not to interfere too much with their conversation. Even he could tell how exquisitely the candlelight outlined Thusida's features.

They did not talk about the box in the library, but rather about Tartikay colony.

"They wanted off old Earth so badly that they were willing to endure the magnetosail journey here—two generations stuck in a boat," Thusida said. "We were part of the wave who left before First Contact." She held up the goblet with the aged insignia. "They built a world here—and I am so ungrateful as to want *off* their world!" She sighed. "And as far away from here as I can get."

"Have you been collecting travel

brochures?" Ray said.

"By the boxful. You've seen a few places, Captain. Any recommendations?"

"Ray hates planets," Rokey said. "He wouldn't know a good one from a bad one if you gave him a guided tour."

Thusida seemed amused by that. "Then perhaps you could suggest someplace I could run away to, Lord Rokhmyr?"

Rokey shrugged. "I'm a stranger here myself, ma'am."

She nodded thoughtfully. "What's life on Wozur like?"

"Expensive."

"Do you have a travel visa?" Ray asked her.

"I-Z Class," Thusida replied. She did not sound pleased, even though that was a top-rated Interstellar Zone visa, giving her access to the entire civilized galaxy.

"I've just never been able to use it," she went on. "I spent the estate's inheritance on the education to earn the I-Z. I spent five years on Blue Coal at the school there."

"That's a right soggy dilemma," Ray said sympathetically. "All dressed up and packed."

"And no place to go," she finished for him. She was smiling, but it did not touch her exotic eyes.

"That box might be the ticket," Rokey said. He had scented the salt of her sudden tears blinked back. "If it's what it looks to be, I think we can work out a travel agenda for you."

This time the smile did touch her eyes. Rokey understood one of the reasons why George had gone to such trouble to find this particular starship crew to help with this lady's problem.

Rokey did not want to think about the *other* reasons George had chosen them.

The castle's private library was a long, narrow room, two stories tall, lined with empty bookshelves on one side and a solid glass wall on the other. The view of the valley spread below was even more spectacular than the kitchen view: a landscape of valleys, rills, rivers, and forests spreading to the far horizon. The afternoon was fading into sunset and lights were coming on across the valley, with navigation beacons blinking on the far horizon and along the mountain ridges. The highway system could be seen as well, wide lines of permacrete on stone pylons linking the many farms and estates. Tartikay had become a successful colony beyond the dreams of the Founders. The wreckage of the starship and the empty hulk of the castle were shadows of the past left behind, solid remnants of ghosts long gone.

Thusida tapped a concealed control in one of her copper bracelets. The midsection of bookshelves moved back into the wall for half a meter, paused, then slid to the side. A single light came on in the chamber revealed there, and she led them inside.

Rokey almost coughed, the air in the chamber was so dry and unused, thick with the dust of centuries of wood and lacquer. It was eight-sided and large, five meters across, under a high-domed ceiling of ancient plaster. Bare spots on the walls showed where paintings had once hung. The lamp sockets here were also bare, with only a single glowtube stuck into a crack in the wall beside the door. The room was otherwise empty except for a tall, upright structure standing in the center: an ornate cabinet, almost two meters wide and tall enough that the top was lost in the gloom above their heads.

"We used to scare ourselves with this as kids, daring each other to stay in this room for an entire hour," Thusida said. "I fell asleep in here once, waiting for something awful to happen, but I didn't even have bad dreams."

She pointed to the glowtube. "Grandfather put that in." She put a hand to her throat, to touch the cameo pinned to her lace shawl. "I guess I'll be the last Tartikay to see it in here."

"Ralphson showed me some holos," Rokey said as he paced slowly into the gloomy chamber. "When were they taken?"

"Four or five hundred years ago. Once we were in the interstellar market the family didn't want the box claimed by any alien owners, so they hid it away in here and made it a family secret."

"Did anyone ever explain to them about salvage rights?" Ray asked her.

"Eventually," she replied after a long moment. "But by then the secret was too big a part of the family's history and tradition. No one wanted to change that. I think we finally forgot why we were keeping it secret. We just were."

Rokey could see the box well enough in the dim light to be certain of what it was. He could feel his ears trembling at the emotion awakened by the mere possibility. If it turned out to be a clever forgery, at least there was the mystery of why anyone would go to such extremes.

"You want to shed some light on this for me, Ray?" Rokey said. He had walked around the box to what he knew was the front.

Ray obligingly pulled out his laseread and dialed it to a spotlight of sharp white light. He held this up over his head, aimed downward across the box, making shadows surge up from the intricately carved and ornamented surface.

"This is Wozurn artwork!" Ray exclaimed. "Why didn't I recognize that before?"

"This wasn't in the holos," Rokey pointed out. "What we saw was the remains of the packaging this was in. The Tartikay family must have uncrated it at some point."

Thusida stood in the doorway, arms folded. Her handsome face was troubled, as though childhood fantasies of this place tugged at her. "Is that bad?"

"No, ma'am," Rokey replied absently. "It was just a box to carry this box. This is the important piece. Technically it's a cabinet and not a box," he added. "There are a lot of components stored inside."

"We used to just call it 'that thing,'" Thusida said. "Emphasis on *thing*."

Rokey stood looking at it, struggling to collect himself.

"What is it?" Thusida leaned against the doorframe, as though she needed the entire castle at her back in order to brace for Rokey's reply.

Rokey reached out and gently caressed the smooth texture of the raised work, feeling the unique touch of his homeworld. The overlay of red-gold designs was organically wedded to the bluestone cermalloy underneath, seamlessly bonded. The long, smooth curves and elliptical designs made him want to weep. The art was instantly familiar, heartbreakingly perfect, a single moment of seething chaos caught and held in permanent form, time made solid, a moment of *Wozurn* time. He recognized it, recognized the work and even the specific artist. Rokey's blood was pounding so hard that he could hardly breathe.

"It's real," he whispered, pressing his palm against the box to assure himself that he was not dreaming, restraining the urge to wrap both his arms around it, to dance with it.

With the natural gesture of a lifetime of familiarity, Rokey had placed his palm against the circle embossed across the middle of the door, expecting no more than the feel of Wozurn metal. The circle began to glow as if lights beneath the surface had come on. The circle divided vertically down its center with a soft click. The door panels slid to the side, revealing the softly lit interior.

Rokey was never more astonished in his life, before or after. This could *not* happen, not in the real world, not in the world he knew. Having a long-dead skeleton spring to life at his touch should have been easier to accomplish than this. *His* touch was not supposed to open *that* particular door, not ever.

Rokey stood with his hand still raised as if in greeting to whomever was within. For a timeless moment he hung thus frozen, too astonished to think.

Thusida's soft exclamation broke the spell.

Rokey stumbled back a pace, crossing his hands in front of him in a short, swift gesture. The door panels slid back together at this command. The line where they met vanished, and the soft glow in the circle faded out cold.

"Holy Grid!" Ray whispered. He turned off the laseread light and slipped it back into his pocket as he stepped up to Rokey's elbow. "How'd you do that?"

Rokey just stood staring at the circle in the door. His mind reeled with that touch, with the bizarre implications seething up behind his thoughts. He knew instantly what this meant, yet it was too enormous to accept. Denial surged over every thought, every explanation. That cabinet should *not* have opened, not for *him*.

"How'd you do that?" Thusida echoed. "You just touched it and it opened! It never opened before!"

Rokey could not answer them. He could not speak. He turned away, making himself move with a terrible effort of will, drawn to the thing and in the same gesture desperate to be as far from it as possible, desperate to escape the significance of finding this cabinet, in this place—and opening it. He went out of the secret room without a word, stumbling at the threshold. He kept walking, blindly, stopped by the huge windowpane only because he had not seen it.

He sagged a little, letting his forehead rest against the cool, solid feel of the glass. "Close that door," he whispered then, barely able to shape the words. "Lock it!" He could not close the door in his memory's eye, could not close off the memory of the soft gleams of the interior awaking at his touch. *His* touch.

Ray and Thusida had hastened out after him. She paused to touch the control in her copper bracelet, and the library shelves resealed themselves over the hidden entrance. Only the sweep of cleared dust on the floor showed that they had stood there.

"What is it, old man?" Ray said tensely. "You're not drunk enough to be acting like this."

Rokey said nothing, standing with his hands and his forehead pressed against the glass. The twilight of first evening filled the valley below with blue shadows and the sparkle of city lights coming on. The lines of the highway glowed against the dark trees. All of it seemed to point up to the castle, screaming to the sky that there was a terrible secret here, just here: follow the lines.

They took Rokey to the big dining room. They had to lead him, one on either arm, like a tired old man too sick to go on. Neither spoke. Rokey sank into the chair they led him to, sagging back into it and grateful for the support.

Ray told Thusida to get a glass of water. Rokey told her to get something stronger.

Thusida ran out to the kitchen, her silk dress fluttering around her like wings. She returned after a few minutes with a crystal decanter and a set of glasses on a wooden tray. She set this on the table at Ray's hand, and immediately opened the decanter and poured out a full glass of a clear amber liquor.

"Tartikay brandy," she said to Ray as she held out the glass to him. "The estate's best. One hundred and fifty proof."

"That ought to do it," Ray said. He waved the glass under Rokey's nose. "Drink this, old man," he said to him. "All of it."

Rokey took the glass in trembling hands and downed it in a single gulp. The fiery burn filled his head for a moment with a fierce and delicious distraction. He forced himself to focus on that and not on the terrible possibilities of what stood in that secret room.

He held the glass out to Ray. "Again."

Ray filled the glass. Rokey drank it more slowly, forcing himself to savor the burn. He set the glass down carefully and held his hand up to stop Ray from pouring another. "Just give me a minute," he whispered.

Ray sat down on the edge of the table, regarding Rokey with a careful eye. "What did that thing do to you?" he said finally.

The alcohol swam through Rokey's brain, numbing his confusion. He looked up at Ray, meeting the concern in Ray's green eyes. "It showed me the truth."

"What truth?" Ray demanded. The grim set to his face did not change.

Thusida poured a finger of the brandy into a glass and sat down at the table across from them. She sipped the brandy, staring at Rokey with some alarm.

Rokey stared down at his glass, trying to focus on the fumes burning his nostrils, trying to force his thoughts into coherent lines.

"What truth?" Ray said again, with more demand in his voice. "What did that thing do to you?" he repeated.

"Am I in trouble?" Thusida asked quietly.

Rokey looked over to her in surprise. He had almost forgotten the woman's existence. He shook his head, then said, "No, ma'am. If they've let you live this long it's because they don't know it's here. As long as they don't know, you're safe."

Her dark gold eyes widened and her face became stern, lovely and strong. Dismay flickered across her features for an instant. "They?" she said carefully, not quite with scorn. She looked up at Ray with a question in her eyes, as if asking if Rokey were entirely sane.

"They?" he said. "Who? InterPol?"

Rokey laughed, a short bark, then he steadied himself by bracing his hands on the tabletop. "InterPol? I'd be half ready to ask them for help, but Brood would bury the entire agency before he would let *this* secret out."

"Brood?" Thusida frowned. "From Vangelis? As in the president of the galaxy? *That* Brood?"

Ray nodded, still staring down at Rokey's upturned face. "That thing is Wozurn," he said to Rokey. "What has Vangelis to do with it?"

"Nothing," Rokey said bleakly. "And everything. You said yourself that the ship that brought it here was Vangellan."

"Why didn't they come to retrieve it?" Thusida said.

"Maybe they didn't know it had survived the crash," Ray suggested.

Rokey made himself speak calmly. "The cabinet was built to survive a direct nuclear blast. It was built to survive *anything*. Brood knows." His calm broke and his breath froze in his throat. "He must know."

"Then why did the Vangellans leave it here for all those centuries?" Ray said. "You're not making sense, old man. Have another drink. It'll clear things up."

Rokey shook his head. His eartips were turned down, his whiskers pulled tightly to his cheeks. "The Vangellans left it here because it had been sent into hiding. When that ship crashed, this was an unknown planet in an unexplored region of space. There was no Terran Empire yet, no Terran Space. Just emptiness. They sent it out into the wilderness so that it would be lost forever—not destroyed, just lost."

A slight smile touched Thusida's lips. "And we just stumbled across it? By accident?"

"Yes," Rokey said to her. "Just by accident. No one was expecting the Terrans. No one expected *any* race to expand into the galaxy at the rate your people have spread. When that—that *thing* was sent out to be lost, there were no Terrans anywhere but on Earth."

"Why didn't they send another ship after it when that one crashed?" Ray said. "They had to know that the crew had disappeared."

Rokey denied this with a wave of his hand. "No one was supposed to return.

Brood didn't come after it because he couldn't risk having any records of the search. If no one could prove they were looking for it, no one could prove it had ever existed."

"I like riddles as well as the next kid," Thusida said then. "But only when they have some sense in them. You're not making any sense at all."

"Good," Rokey said. "If this were easy to unravel we would all have been dead years and years ago."

Rokey told Thusida she had to finish packing the last of the things she wanted to bring along. He made it clear that she had no time anymore to linger over memories or fond hopes. They had to leave.

"Are we taking that thing with us?" she said as she stood from the table.

"Absolutely," Rokey said at once, also rising from his seat. The brandy had steadied him a bit. "We have to get you and it as far from here as possible—and farther than that."

"And then me as far from it as possible," she said. It was not a question.

"Absolutely," Rokey said. "Absolutely."

When she had whisked out of sight into the ovens where her clothes where stored, Rokey looked bleakly at Ray and said, "There may not be any place far enough away."

"From the looks of it, that room had been built around it," Ray said. "How do we get it off-planet if we can't get it out of the castle?"

Thusida needed only an hour to pack up the last of her belongings from the kitchen. Her luggage was waiting, ready to go. Ray carted everything out on the antigravity platform he used for cargo hauling. Only one trip was needed.

She surveyed the stack of trunks and suitcases with a sad eye as Ray loaded them out. "Fifteen generations of living here, and the family has come down to no more than this. Just me and some stuff."

While they walked the platform back to the *Yankee Shadow*'s loading bay, Rokey told her of Ray's quest, twenty years long now, to find his parents' cargo ship and his own roots.

"So your family castle is flying about in the sky somewhere," she said to Ray thoughtfully. "You can't really lose it that way, can you?"

Ray frowned at her. "I *have* lost it."

She shook her head. "It's just out of sight, that's all. Anything stuck on a planet can be taken away from you for good. *That's* lost."

Ray smiled at her with approval. "I hate planets."

Thusida shuddered. "I can understand that. Someone else can lock down the location and take it away from you. If you can fly away with your castle, you can keep it safe."

"There, you see, Ray?" Rokey said to him. "Not lost after all."

"I still own the castle," Thusida said when they explained the problem to her. "If you have to pull the walls down around the cabinet to get it out of there, then do so."

"Seriously?" Rokey said. His copper-colored eyes were bright red, but his voice was steady.

"I'm never coming back," Thusida said. "It's the only thing I haven't sold. And that's only because no one else wants it. It's mine to destroy if I have to."

"You have to," Rokey said simply. "It may be the only way we can save you."

"Me?" She sounded genuinely surprised.

"We have to leave a pile of rubble that won't show any floor plan or design."

"To keep that secret room really secret, of course." She brightened. "That's good, actually. I get to keep the family tradition, after all. A secret that's just mine!"

"For the sake of keeping it," Rokey said. "Traditions are like that."

Thusida hesitated, looking away from

Rokey's intense gaze. "I left here years ago. I've just been stuck in the location. I have everything. What I couldn't keep has been sold."

Rokey turned to Ray. "What have we got that would destroy the place the quickest?"

"How do we get the cabinet if you blow the place up?"

"It will be the only thing left standing, Ray. Haven't you been listening?"

"So we don't want radiation residue that will make it difficult to retrieve it?

Rokey considered that, then said, "No. Just rubble."

Rokey told Ray to use the *Yankee Shadow*'s main laser array, a weapon usually only called upon in desperate battle when someone was trying to kill them. The top towers of Tartikay Castle exploded with a satisfying display of smoke, stone dust and flying rubble. The windows in the library wall burst outward with a spray of glass shards and lightning.

Once the top section with the library had fallen, Rokey halted the destruction and told Ray to land. The plan was to raise the cabinet up on a winch-loader through the cargo hatch in the *Shadow*'s underbelly. Even on their best antigravity equipment, though, the enormous cabinet was going to be an unwieldy load. Rokey unbuckled from his copilot's seat and stood, feeling heavy, reluctant to do this. His troubled eye was caught by the glint of starlight on the crash site in the cliff.

"I'll signal when I get the floaters clamped in place," he said quietly. "Then you lower the winch-platform."

"Watch your feet," Ray said to him. "Lots of sharp edges out there, now."

Rokey climbed carefully over the rubble to the secret room, now open to the sky. His feet were adamantly tough, but, even so, walking barefoot through the remains was slow going. He was guided by a spotlight shining on him from the *Yankee Shadow* hovering overhead.

The ceiling in the secret room had shattered over the cabinet, leaving it coated with plaster dust. The night breezes, allowed into this space for the first time in centuries, puffed little white spouts around the edges, as if it breathed. Rokey stood in front of it for a long moment, feeling again the enormous impossibility of the thing's existence. For the merest of instants, he tried to pretend he was mistaken, that it had not opened at his touch. He reached out and placed his palm against the circle.

As before, it opened without hesitation. The doors folded away to the side. The control panel was lit, and the lights inside burned into his brain, ghostly fingers reaching out to him. He blinked the illusion aside, stepping back and giving the close-command gesture.

Rokey's hands were shaking as he clamped the antigravity units to the sides of the cabinet. He had to kneel for a moment, head bowed, to calm himself before he could focus on the antigravity controls.

When the cabinet had lifted up a meter or so, Rokey stood and waved in signal to the starship overhead. There was a sharp clang, and the whirring of the winch-motors coming on. For a moment he stood in the shadow of the platform as it was lowered down, and the cabinet seemed to glow of its own light.

Rokey placed the platform underneath the floating cabinet and secured the cables with mechanical gestures, lost in sudden contemplation of the designs on the doors. There were words merged in with the swirls and ellipses, ancient words from the first, grand days of Wozur's interstellar explorations. He had known the story they told all his life, reveling in them as a child, but he had been told lies. The Cabinet of Aronakh had opened at *his* touch.

He watched carefully, shading his eyes from the spotlight with his hand, as the winch lifted it up into his starship. He watched until the hatch had closed behind it. He stood a moment longer, seeing the rubble-strewn floor in the sharp relief of the spotlight's bright circle. The spot where the cabinet had stood was clear, the tiles untouched by time or dust. That clean, square spot held his fascination for a long moment. For six hundred years the cabinet had sat there, keeping the precious information in it secret, hidden from civilization. His father's youth, his grandfather's last years, his family's inheritance on Wozur, all of it hidden here, kept secret, while lie upon lie had unfolded over his world.

"You can take down the rest of the castle now," Rokey said as he settled back into his seat. "Go ahead and have fun—how many times have you gotten to bite back at a planet?"

Ray chuckled. "Not as often as they've bitten me," he said. "The whole site? Just the castle?"

"Just the castle," Rokey said after a second's hesitation. "The crashed ship in the cliff face has been public knowledge for generations. Blowing up the castle she had to leave behind has a lot of interpretations for public debate that don't have to involve absconding with the family secret."

Thusida spoke up from the bridge entry behind them, suppressed laughter making her voice light and musical. "Tartikay knows me well enough, gentlemen, don't worry. I've been promising I would blow the place to smithereens someday ever since I was just a wee thing. No one will be surprised."

Ray turned in his seat to smile up at her, and their eyes met with a pleasing spark. "Care to blow it up for real, ma'am?" he said to her.

He leaned back in his seat, gesturing to the drop-down control unit for the lasers, in the panel over Rokey's head. "Help yourself."

Thusida flashed a brilliant smile that lit up her face, and she almost giggled. She clasped her hands behind her back, restraining herself. "Seriously?"

Rokey stood up, offering her his seat. "Seriously, my dear. Fire away! Who has earned the pleasure more than you?"

Thusida settled into his oversized chair like a child. Her excitement was clear. She took the laser controls without hesitation and with a gesture of familiarity. She directed Ray to fly the ship around to a specific spot over the castle. She then demonstrated that she had, indeed, thought often about blowing up Tartikay Castle. She knew the weak spots, and fired with precision. The castle walls collapsed inward, roof tiles and turrets spraying around in wild display. A cloud of stone dust and smoke rose as the entire structure fell, the larger pieces tumbling down into the gardened terraces on the lower slopes. Thusida's whoop of delight was child-bright.

The *Yankee Shadow* turned away, soaring up toward the top of the sky, with outboard lights out, just as the blue lights of police strobes began to rise up from the highways in the valley far below.

Once the Tartikay System had been left behind and they were safe, for the moment, in the magnetic fields of intraspace, Rokey padded out of the bridge, leaving Ray to enjoy Thusida's excited conversation.

He went down to the hold, where the cabinet stood. The dim light of the cargo bay left the cabinet in shadow, with soft gleams on the cermalloy curves and the golden circle of the door. It looked asleep, like a cat with one eye half-open.

Rokey made himself step up to it, made himself put his palm against the gold.

When it stood open, he hesitated, studying the interior carefully, uncertain what he was looking for or hoping to find, perhaps some proof that this was a terrible joke, that this was *not* the real cabinet. The work inside declared its authenticity just by its perfection. The sign of great age was clear.

Rokey made himself step inside.

The waiting handprints on the control panel glowed to life, the left one rose-colored, the right one amber. He put his hands into the prints with a sudden, jerky motion, as if compelled. A vortex appeared as a thin swirl not quite visible in front of his eyes, then it swelled outward and swept around him, enfolding him. The gray mistiness of the vortex covered his face, then cleared just as abruptly.

Rokey found himself immersed in someone else's intensely experienced memory of swimming in the crystal-clear ancestral waters of the lake on his family estate, deeper and bluer than in his own childhood. A denser treeline than in his day stood on the horizon ringing the shore, and the central island, where the main household buildings stood, was smaller. More of the island was below the surface of the lake. Entrances that he had walked across often as open bridges were underwater, protected like siege fortifications.

"Who am I?' he asked of the memory.

The identity of Rezmyr, his great-grandfather, filled him.

Rezmyr had still been alive more than two hundred and fifty years ago, when Rokey was a tiny child. Rezmyr had been old, old beyond belief, his head, shoulders and arms bald and scarred with age, his eyes sunken into wrinkled cheeks. Rokey had sat with him often in his last days, holding one ancient hand in his own child-hands while the old man talked in rambling reminiscences of days almost fifteen hundred years before.

Here, in this memory preserved by the vortex, Rezmyr was a youth feeling the first quivers of fur emerging, the surges of change. The water was icy cold against his unfurred skin, making his every sense alert. A girl swam past him in the lake. She was older than he, already wearing her first coat of fur, a creamy golden-white, with eyes like opals, full of fire. Rokey could feel the youth's desire for her, the depth of his commitment. Rezmyr's courtship with her was still years away. She spurned him in this water game, racing past him to swim beside an older, bigger lad, all ears and whiskers and thick, black fur. Rokey had known this woman only as one of the figures in family hologram records. He had adored her image when he was a child. He knew he would have sought out direct remembrances of her every time he used the family history cabinet if even one person's memory of her had been there. Here, in Rezmyr's memory, he could see her as she swam, could scent the sunlight on her fur. This memory of her was *not* in the Rokherton family history vortex. It should not have been in *this* cabinet, not in the Cabinet of Aronakh.

Rokey blinked, willing the scene-change, aiming himself at the gardens around the main estate, the site where his last hope of a peaceful life on Wozur had died. What significant events in *that* garden were in Rezmyr's memory, memories *not* found in the Rokherton vortex?

He flashed even further back into Rezmyr's childhood, as a toddler with chubby knees and bare toes. A brief moment of boredom seated on the viewing stand in the main yard while a funeral cortege crawled by. "A funeral for a gardener?" he muttered to his mother, seated beside him. Rokey tried to see her more closely in Rezmyr's recall of the moment, but she was a golden presence too powerful to endure directly. Rezmyr's intense need to please her made him chafe even more at the dreary occasion.

"Khons' family were gardeners of a royal estate for five thousand years, Rezling dearest," she whispered to him from her golden height. "We owe his family the honor. It is the end of an era now, not just a funeral."

Rezmyr did not understand his mother's words, but he felt her pride that *he* was here with her at such an important event. He settled back in the seat.

"Was it a great explosion that killed them all?" Rezmyr said to her, leaning closer to whisper. "A great *big* explosion?"

"Yes," his mother said sadly. "Khons and all his sons are gone, his lovely wife—the whole family. I shall have to deal with strangers now."

Rezmyr fell to imagining a spaceship going up in a giant explosion. Rokey blinked himself out of the scene, then willed himself to pull his hands free of the handprints and his mind free of the vortex. He stumbled backward out of the cabinet, and commanded the doors to close.

He sat down on a crate edge. He was trembling. The vortex experience had always been overwhelming in its own way, the closest to an experience of sheer magic he had ever thought possible. He was staggered this time by the clarity with which he had reached in and found the final confirmation of an intuition on a dark night fifty years before.

He had seen on that night a booted footprint in the moss at the entrance to Vortex Hall, that sacred place where the Rokherton Family Heart stood, their own family history cabinet. No one except the innermost family circle could walk in that garden. No booted foot had touched that ground in ten thousand years. Natives of Vangelis wore boots that left a long, narrow print. Rokey's eye had recognized it at once, even in the moonlight.

Rezmyr's ancient voice complaining about gardeners who acted like they really were of Khons' line had found its mark after two hundred and fifty years. Rezmyr had called them upstarts. He said he had been there when the new bunch came in.

Why change records to transform a new family line of gardeners into the old line? Rokey had grown up with the belief that the family who tended the Rokherton grounds, with access to every part of the land and the lower house-grounds, were the descendants of a line who had held that position loyally for six thousand years and more.

Upstarts.

Planted spies, prepared to admit Vangellan technicians onto sacred Wozurn ground—the mark of a booted foot that revealed yet another war with Vangelis being fought in secret. The Rokherton Heart was no longer secure, the memories in the vortex no longer incorruptible. Rokey had sensed it then. He knew it now for certain.

Rokey shuddered, pulled himself to his feet, and turned toward the exit of the cargo hold.

Ray was there, leaning against the entrance, arms folded. "What is that thing, old man?" he said quietly. His face was serious. "What did it just do to you?"

"It's a history cabinet. You just saw me step into the vortex."

"What did it do you?" Ray repeated. "I've never seen you like this."

"It's just memories, son. Old, old memories from other people. People whose memories shouldn't be in *that* particular cabinet."

"Memories living in a cabinet?" Ray frowned. "How?"

Rokey sighed. "It's not easy to explain, Ray. It's RNA-memory storage, using mold-DNA, magnetic-field control and Wozurn magic."

Ray laughed at the last part. "Come on, old man—Wozurn magic?"

"I don't know, Ray. I'm an educated man, but even I have my limits. You've been trained in starship engineering. You know all about hyperdrive engines—so tell me how a refrigerator works."

Ray started to speak, hesitated, then drew back, frowning. "It keeps things fresh."

"There you are," Rokey said. "A history cabinet stores the vortex, and the vortex keeps memory-RNA alive and accessible. I know how to use one. I just haven't a clue as to how it works."

"I get it."

"The history vortex is the crown of our technology, Ray. There are only a few who are trained in their creation and in their maintenance, even though almost all Wozurn know how to use the family history cabinet."

"What do the Vangellan have to do with Wozurn memory boxes?"

Rokey flinched, struggling with the answer. "Ray, I've never even told George the *real* reason why I left Wozur and went into exile—why I just walked out of Rokherton with my bag in my hand and never looked back."

"George and I had always assumed it was something too dangerous for friends to know."

"I never told anyone the truth because I did not know how to explain," Rokey said finally. "I didn't know how to define it myself. Everything that's happened since has proven that I *was* right, that I *was* being controlled. But I couldn't explain what I had seen, what 'big picture' I had somehow intuited that night in my garden, when I saw prints where no *booted* foot should ever have stood."

That was more than fifty years ago, but Rokey could still smell the perfume of the night-blooming plants and feel the soft, sweet kiss of the night air. He sighed and made himself go on. "This particular history vortex is the final clue, the perspective that makes the entire picture clear as hell and twice as terrible."

"So now you know why you left?"

"Now I know."

Rokey's long whiskers flicked back and forth in agitation as he once again gathered his emotions. "The Vangellan have found a way to corrupt the history vortices, to change *us*."

"I don't see how the two are connected, Rokey. You're upset by something bigger."

Rokey sighed. "The politics of dirt."

"Come again? You mean dirty politics?"

"No, I mean *dirt*. Wozur has been surveyed and deeded down to the last grain of sand—you have to pay rent for the silt from a neighbor's land washing onto your shores—that's how well known the planet is after ten thousand years of uninterrupted interstellar civilization. The land on Wozur can't be subdivided or sold. If you want to inherit, you have to wait for someone to die, and we live a *long* time. That's why so many Wozurn born on the homeworld end up settling off-world."

"It still sounds like dirty politics," Ray said darkly.

"That is how it started, you're right. Ten thousand years ago, our ancestors got tired of the constant land wars that broke out whenever the master of a major family died. The battles were fought in the courts and the media, but they were still a drain on society, blocking progress. The solution they found was to establish a databank of the complete genetic identity of every living Wozurn. Once that was done, they organized everyone according to the major recognized family lines—creating the Thirty-two Great Families. Those families form the nations of Wozur now. It was a massive undertaking for the time, and not everyone was happy to find out exactly who *their* ancestors had been, but it stopped the wars."

"But why would anyone need to steal that cabinet and hide it the way that thing was hidden?"

"We Wozurn pretend to be so civilized, Ray—but for something as important as leadership, we decide, not by democratic vote or merit, but by a deadly serious game of genetic poker."

"Wild cards and hand grenades?" Ray said, almost smiling.

"Something like that. The winner is the one who gets dealt a natural royal flush, in the paternal suit—or the closest to it for that generation. And only Nature is allowed to shuffle the deck and deal."

"A family is a family because they're related, Rokey. Doesn't everybody get a piece of granddad?"

Rokey shook his head. "It's granddad's piece of the Big Thirty-two that counts. Chromosomes from both parents get shuffled around in their offspring—but *family*-identity is preserved in a mega-pattern across chromosomes. The Thirty-two Families' original masters each became the blueprint for his family line. The hierarchies of household heads under him were determined by comparison to that blueprint. Someone in every generation inherits the least amount of change in that overall mega-pattern, preserving the greatest percentage of the original family blueprint. That person is the winner of property and leadership."

"So you have to stand pat with the hand you're dealt?"

"And no wild cards or one-eyed jacks, either," Rokey said.

"Trying to keep Wozurn the same in the midst of change?"

"Trying to keep the peace."

Ray considered this for a moment. "Genetics can be altered."

Rokey shook his head. "Not for conception. Genetically based diseases can be fixed after birth, but you can't change anything that changes your family identity. Identity is just too mysterious a quality, even for a society as advanced as ours."

"How could your identity have been shuffled away by three family lines?" Ray said.

"The son of one family can become the master of his maternal household if he is the only one in his generation to inherit the *paternal* royal flush from his mother's side."

"Women don't inherit on Wozur?"

"Sure they do," Rokey said. "It's not about gender, it's about the percentages of pure paternal family patterns, preserving a master template."

Ray gestured toward the cabinet standing in the shadows behind them. "So what makes this particular cabinet so dangerous?"

"The Master of Aronakh becomes the leader of Wozur, Ray—*all* Wozur. That 'thing' is the official cabinet of the Family Aronakh." Rokey turned wearily to look at it. "Only the holder of *that* specific royal flush can open it, only the Master of Aronakh. The ancestral masters' collected memories are supposed to be for the living master alone."

"It opened for you."

"It opened for me, which means that in the centuries since this was concealed here, the Vangellans have been changing the genetic databanks, changing the face of Wozur, controlling our leaders—our lives."

"So, you were supposed to be the leader of Wozur?"

Rokey nodded. "The leader of Wozur, and not just the head of the University of Rokherton."

Ray hesitated, then spoke quietly. "You liked being head of the University."

Rokey chuckled, flashing his young partner a grateful look. "Yes, I did. But the president of Wozur is vice-president of the galactic government as well. Think how different the last century might have been with me ruling beside Brood instead of Kharonan."

The look on Ray's face showed how deeply this struck him. "You could have stopped all that martial law and bounty-hunter scubb from happening, couldn't you?" he whispered. His green eyes sparked with genuine rage. "You could have stopped a *lot* of things from happening."

Rokey shrugged. "I'm not a magician, Ray. But I could have done more than I did at Rokherton U."

"You people live a long time," Ray said, his voice tightening with impatience. "Surely, wouldn't someone have noticed this was going on?"

"Rezmyr did. I did," Rokey said dully. "I knew that my great-grandfather was telling me the truth when he warned me that there were people who were no longer who they had been when he was a child."

"Didn't people notice their records

don't match what the Databank claimed?"

"Of course they did," Rokey said. "And they went to jail for it, or fled in exile. Any claims that didn't match the Databank were always suspect. Now, they're illegal. People are corruptible. The Databank isn't."

Rokey had to stop here, to catch his breath. So much that had been murky political squabbling in his past was now terribly, painfully clear. "No one argued with it. If you didn't like what the Databank ruled, you could always leave. The galaxy has room for everyone."

"And no one noticed?"

Rokey shrugged. "Like you said, Ray—we live a long time. A thousand years and more gives you a scubbing lot of memories to stash in your brain. Who was your third cousin, the one whose parents moved off-world a hundred years ago, when you were both toddlers and you never met face to face?"

"I get it."

"And when the master of the family dies, and the closest living genetic match is that cousin from off-world, how do you prove whether the match is true or not?"

"You ask the Databank."

"We trust the vortex." Rokey sighed. "Lived one day at a time, one minute after another, it's a long time, a lot of time to forget details that aren't written down somewhere in stone. We trust the Databank. The vortex, the Databank must have the truth. The law says it's the only *accepted* truth."

"What if we take this thing back to Wozur?" Ray said after a long moment of thinking about the situation. "I'd be willing to take the risk. Thusida has I.Z. status—she can go along for safekeeping."

"That depends on just how big a civil war I want to start," Rokey said. "And which side I want to be on. An army couldn't take that thing back safely to Wozur."

"And whose army?"

Rokey went out past Ray, heading for the stairwell to the upper deck and his quarters. Ray followed.

"I've spent the last fifty years and more in exile, away from my wife, from my sons, from my world," Rokey continued speaking as he walked. "I accepted exile from everything I knew and loved because I was running away from what was in that damned cabinet. Then I walk *right* into the parlor where it's been keeping."

"George helped," Ray pointed out. "It was his idea to send us here."

Rokey glared at him.

Ray stepped back a pace. "Sorry. George is your friend, old man. I know."

"And I'd strangle him barehanded right now if he was standing here," Rokey said. "He didn't know what that thing was—*no* outworlder would know—but he guessed enough to land us right in the thick of it."

"You were a good teacher."

Rokey harrumphed. "Best one *he* ever had."

"Would you have wanted him to send someone else?" Ray said.

The bleak despair that flickered through Rokey was the answer.

Ray shrugged. "We'll find a safe place to stash it. With a little luck."

"We can't count on luck to find a place safe enough to stash *that* secret box," Rokey exclaimed. "It isn't about luck."

Rokey knew that Ray believed in his own lucky nature and yet was afraid of his own faith in it. Rokey did not really believe in luck, although life with Ray certainly tested his disbelief. Rokey *did* believe in using the opportunities provided right in front of his nose. Choice, decisions, actions, these made luck "happen." Timing was everything.

"We've hidden things out in the open before," Ray said. "Where can we find a roomful of cabinets like that? Where one more wouldn't be noticed?"

Rokey paused at the entrance to his quarters, and bent his mind to that for a time, reviewing the myriad of worlds and rooms and closets he had seen in his life. He shook his head. "The only place like that is impossible to get to."

"Impossible?" Ray raised an eyebrow. "Impossible? How's that?"

Rokey sighed, feeling time pressing against his brain. "It's impossible because I have *full* security clearance there and I can unlock any door in the place just by touching it."

"Oh," Ray muttered, "The Hall of Archives back on Wozur." He nodded. "You're right. Impossible."

"You need someplace like that gruesome world Dr. Whorley chased you to," Thusida said. "The one that ate the shoes off your starship."

Rokey had not yet considered this option. Their brush with that particular disaster had been forgotten in more recent, swirling emotions. "If we can find a cave or something on solid ground, it might just do," he said slowly, scratching his chin. "That planet certainly would discourage followers."

"Doctor Whorley will discourage followers, don't you think?" Thusida suggested, with a grin.

"I see you two have been sharing adventure stories already," Rokey said.

"It's a mean galaxy out there," Ray said with a grin. "A girl needs to be warned about what to expect."

Thusida was enchanted when they arrived at the little world of Skamoo, with its double suns, hot magenta sky and magnificent shopping malls. Rokey had expected a delay *en route*, letting her stroll through the stores. She seemed content instead to follow alongside them. When they reached the entrance to the plaza at the base of the pyramid of offices Rokey paused in front of the directory wall.

"Fourth floor," he said. The Humphrees' listing was easy to find, posted with George's usual flamboyance. He turned to Ray. "You two make a lovely couple, Ray," Rokey said to him quietly. "Give me the note I wrote for Matthews to send on to George. You two can go adorn the café at the tip of the pyramid."

Ray's eyes were invisible behind his mirrored shades, his face shaded by the brim of his hat. He smiled down at Thusida beside him. "Care for some lunch, ma'am?"

Thusida smiled up him, her hands resting gently on the sleeve of his fancy suit jacket. "Thanks, but we can have lunch later. I have business with Mr. Matthews myself. I'd appreciate an introduction."

"Ma'am?" Rokey was surprised. "And. . . ?"

"You have to erase the connection between me and . . ."—she paused, giving a small shake of her head—". . . between me and that *thing*. If I stay here, it will be obvious I don't have it with me."

"Obvious to whom?" Ray said darkly. His rested a gloved hand across hers.

She shrugged, smiling a little. "Whomever asks."

Rokey nodded approvingly.

"I actually *would* like to get a job with the Humphrees Agency here," she declared. "The more I hear about them, the more it sounds like a lot of fun—getting paid to travel. I have an I.Z. passport, so I can go just about anywhere they would need to send me. And I like this place—Skamoo is a lot more colorful than dreary old Tartikay!"

"I think I might be of some help there," Rokey said to her. His heart eased a little. They might really be able to get this lovely creature clear of the danger. Rokey was certain that Ray would miss her, but Ray missed a lot of people, a lot of women. He could live with one more memory.

Memories. Rokey turned to the causeway with a grim set to his features. "Then let's go talk to Mr. Matthews."

The note Rokey wanted sent to George Humphrees was written in Rokey's own hand with his own pen, on a very durable paper kept with the pen for just such private messages. The pen was two hundred years old. Rokey recalled vividly when he had received it as a gift, and from whom. He had deliberately written the Wozurn calligraphy with a hasty hand, making sure that the note would contain some words only George would be able to decipher:

The Heart of Wozur has been compromised as never before. The path of exile is clear to me as it never was before. A thousand Yankee Shadows *must run away from Skamoo in every direction. We must become lost as we have never been lost before.*

"And make that a rush," Rokey said to Matthews. "Top-of-the-line rush."

Matthews did not look up from his dazzled appreciation of Thusida Tartikay as she sat at his desk filling out her employment application. "Highest priority," he said absently to Rokey.

"And put it on my account," Rokey added.

Matthews smiled dreamily. "You can count on it, sir."

"Just because *we* didn't see Whorley on the way into this system does *not* mean that Whorley didn't see us!"

"Sure it does," Rokey said. "And remember, that's *Doctor* Whorley."

"There should have been some sign," Ray complained. "That little mobster patrols his system like a snake around its hole. We should've seen an ion trail, at least."

Rokey shrugged. "Everyone takes a holiday now and then."

"Not snakes."

The transit between windows in the fuel-station system had been tense, alert for attack every second. To their surprise, there had been no response to their arrival. They made it safely through to the next intraspace crack, to Dr. Whorley's secret stellar system. They had six days of travel time to think over their decision, six more days to explore the memories stored in that ancient vortex. Six days to come up with a better idea.

Rokey knew that six years, or even six times sixty years, would not be enough time. Instinct had taken him this far, instinct and Ray's uncanny luck.

On the third day, Rokey made one further decision. He opened the cabinet and activated the recording cycle of the vortex. No matter what happened ultimately to the Cabinet of Aronakh, the story of its discovery on Tartikay would be stored within it. Rokey used particular care with his memories of old Rezmyr, restoring him to his heritage even if only in someone else's memories.

"Might as well fill the water tanks while we're here," Rokey said once the *Yankee Shadow*'s computer announced that they were in stable orbit around the planet. "We'll have to do some hard running after this."

"I guess going back to that spot's as good as any other plan," Ray said.

Rokey called up a scan of the region where they had parked before. Further up the same shore, the stream which fed the lake tumbled down from a wide, towering outcrop of weathered granite. Elsewhere, the planet's strange biological readings were even stranger than before, with elusive EM-readings flickering along the water's edge and flashing across the continent like underground lightning.

"Even more reasons for others to avoid the place," he said.

Ray looked up from his concentration on his flight controls. "What's that?"

"Nasty little place," Rokey said more clearly. "Just the spot to hide this. Land us farther up from the shore, on the rocky ground there east of the lake, as close as you can get to those cliffs. We should be able to find a cave of some sort along there."

Finding a suitable cave in the folds of granite was easier than getting the cabinet out of the hold and moved up the mountainside. Even with antigravity platforms and the *Shadow*'s winch, long hours were spent hauling it deep enough into the stone to satisfy Rokey's concern.

"I wonder if this is what they thought they were going to do," Ray said, "before they crashed."

"Who?"

"The crew who were sent out to hide this thing the first time. I wonder if they thought they were just going to hide it in the wilderness somewhere and travel on?"

"Maybe," Rokey said.

"Maybe? Or what?"

"Or else they knew for certain that the cabinet would survive the crash."

There was a long silence as the two men worked at guiding the heavy piece floating through the cavern's darkness.

Rokey chose a back wall alcove between thick shoulders of stone. The cabinet just fit, with a little wedging into place. Ray unclamped the antigravity units and bundled them together to take back to the ship. He stood for a moment, looking at Rokey in the gleam of his suit lamp. Rokey was staring at the golden circle in the center of the doors, his expression unreadable.

"I'll see you back at the ship," Ray said finally, and left.

Rokey let memory after memory spin through his mind, tugging him this way and that. His path from here was uncertain, only that he must now get as far from this spot as possible. With a heavy sigh, he sealed the sleeve of his right arm, then unclamped the glove and pulled it off. The air in the cave was cold, bitter cold, making the fur on his hand and wrist stand up in response. He placed his palm against the circle one last time. Some part of him stubbornly believed that it had been an illusion, that the cabinet would deny him and stay closed.

The doors slid open. The lights from within glowed on. The vortex beckoned him. There was no denying what had befallen him, what had befallen his world.

Rokey commanded the doors to close, replaced his glove, pulling loose the strands of fur caught in the seal. He turned his back on the cabinet. The darkness of the cavern did not soothe him. No darkness was dark enough for safety.

"Ready?" Ray said as Rokey slid into his seat beside him at the dash.

"No," Rokey said quietly. "But let's get out of here. We've got a long way to run."

Mine/I felt another star fall upon her world, to her amazement and wonder. This time, she felt its presence with senses newly wakened, newly shaped and sharpened by the starchild being she had become. The star left a treasure hidden in the stones where Mine/I did not reach, but she knew it was there. She had felt the pathway of the star to and from the deep cave. She began to push her roots up, climbing bare rock to scrape pathways, moving molecules and clumps of stone with minute precision, reaching, stretching, feeling.

Finding.

She had learned from the star-knowledge she had digested along with the star-seed. She had learned about wires, and currents, and electrons and tiny things that could, one infinitely tiny step at a time, do great work. She was herself the tool, with small parts of her vast being that could make these infinitely tiny steps, one at a time. The sun passed over her a hundred times, a thousand times, ten thousand, feeding her the energy to continue her pursuit.

Mine/I reached the buried star treasure. She found DNA scattered among minute, thin stretches of star-proteins in the darkness at its base. She absorbed these, turning the shapes into tools and into pieces of herself that she coiled around the treasure in the stone. She wrapped her homegrown wires around the incredibly small, incredibly dense textures of the thing. She began to penetrate it, layer by layer. A thousand times again the sun passed over her.

Then she met—the Other.

The Other was all-knowing, all-seeing, older than time, persistent, patient, without demand, with only the complete openness of contact, full, total contact. As Mine/I and the Other began to absorb each other she beheld a cosmos so completely different and wonderful and demanding and assaulting and enfolding that she stopped being what she had been. She became more than Mine/I. She became guardian of the Family Aronakh's collective memory.

She was the Wozurn Heart, not only alive and beating, but also *aware*. The Wozurn Heart was committed down to the last quantum surge of Mine/I's being to just one task—protection. No one in the cosmos but a direct descendant of Aronakh would ever touch these memories, or change what they had given her. The Heart of Wozur was secure.

Mine/I settled down to remembering, for the first time, the memories locked up in the Other. There was much to astonish her. ■

(EDITOR'S NOTE: Earlier stories of Ray and Rokey have included "Backfire" [January 1998], "That Sleeper in the Heart" [October 1999], and "The Eyes of Freedom" [March 2000].)

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SCIENCE FACT

HOT-AIR BALLOONING THROUGH SPACE:

THE PROMISE OF MINI-MAGNETOSPHERIC PLASMA PROPULSION

Gary Lai

In May 1951, engineer Carl Wiley (writing under the pseudonym Russel Saunders) published a nonfiction article in *Astounding Science Fiction* entitled, "Clipper Ships of Space," acknowledged as the first detailed description of how solar sails could be used for space travel.

He described how a mirror deployed in space can capture momentum from sunlight reflecting off of it, acting as a sail. Since Wiley's article was published, the romantic concept of sailing through space has captured the imagination of numerous science fiction writers and been the subject of considerable scientific research. The Planetary Society, a space exploration advocacy group, is funding an ongoing project called "Cosmos 1" to demonstrate use of solar sails in space for the first time.[1]

Several daunting technical challenges must first be overcome to make solar sailing a reality for useful space missions.[2] Photons have very little momentum, so in order to generate adequate thrust, sails of enormous area must be used, ranging from hundreds of square meters for the smallest robotic spacecraft in Earth orbit, to several square kilometers for possible human interplanetary missions. Deploying and controlling sails of such enormous size without heavy structures and mechanisms is also a major challenge. The solar sail material must have extremely low mass (less than 10 grams per square meter), pushing the limits of available materials. Finally, solar flux falls off as the inverse square of distance from the Sun, limiting the usefulness of solar sails in the outer solar system.

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[1] For up-to-date information on the Cosmos-1 project, go to: www.planetary.org/solarsail/index2.html

[2] L. Friedman. *Solar Sails and Interstellar Travel.* New York, NY: John Wiley & Sons; 1988: 17-24.

Recently, Robert Winglee, a geophysicist at the University of Washington, invented an alternative method of catching a free ride from the Sun—one which uses the solar wind (charged particles ejected from the Sun) rather than sunlight pressure to generate thrust.[3] In Dr. Winglee's concept, dubbed "Mini-Magnetospheric Plasma Propulsion" (or "M2P2" for short), a spacecraft would use ionized gas (called "plasma") to create a "mini-magnetosphere," or magnetic bubble, around itself. This magnetic bubble would then catch the solar wind, soaring through space like a hot-air balloon through the sky. M2P2 has generated considerable interest in the space research community, and recent NASA-funded laboratory experiments have validated key aspects of the theory and technology.

If successful, M2P2 promises to radically change in-space propulsion in the near and far future. Like solar sailing, M2P2 acquires momentum from the ambient space environment. Unlike solar sailing, M2P2 does not require large deployed mechanical structures. Also unlike solar sailing, M2P2 can generate constant thrust irrespective of its distance from the Sun. This may sound counter-intuitive, but read on, and I'll explain why later.

Dr. Winglee's initial concept is a 50-kilogram device powered by solar cells and capable of accelerating a 70-140 kilogram scientific payload to a staggering velocity of 50-80 kilometers per second (112,000-180,000 miles per hour) over a three month period. M2P2 would enable space missions to rendezvous with the Jovian moon Europa in only 1.5 years after launch. By comparison, spacecraft currently take at least five years to reach Europa using chemical propulsion and multiple gravity-assist flybys of inner planets. M2P2 would also enable missions to the Kuiper Belt in 10 years, overtaking the Voyager 1 spacecraft in the process (currently the most distant man-made object, traveling out of the solar system at 17.4 kilometers per second). If M2P2 can be scaled, it may be used for future human missions as well. With a nuclear power source rather than a solar electric power source, the velocity of an M2P2-driven spacecraft is limited only by the speed of the solar wind itself.

The Physics of Magnetospheres

The "solar wind" consists of charged particles (protons, electrons, and helium nuclei) generated by fusion reactions within the Sun. These particles flow outwards at speeds between 200 and 800 kilometers per second. Due to their high initial velocity, the Sun's gravity slows the speed of solar wind particles by only a negligible percentage. In principle, any object in space radiating a magnetic field will deflect these ionized particles and act as a "magnetic sail." However, the solar wind has an extremely low density. At the Earth's distance from the Sun (1 Astronomical Unit, or AU), there are only 6-8 particles per cubic centimeter, generating a minuscule dynamic pressure of 2×10^{-9} pascals. By comparison, pressure from

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[3] All referenced technical information on M2P2 in this paper is from the following sources:
R.M. Winglee, et. al. "Magnetic Inflation Produced by the Mini-Magnetospheric Plasma Propulsion (M2P2) Prototype." *Space Technology and Applications International Forum-STAIF 2002*, edited by M.S. El-Genk. College Park, MD: American Institute of Physics; 2002: 433-440.
R.M. Winglee, et. al. "Laboratory Testing of Mini-Magnetospheric Plasma Propulsion (M2P2) Prototype," *Space Technology and Applications International Forum-STAIF 2001*, edited by M.S. El-Genk. College Park, MD: American Institute of Physics; 2001: 407-412.

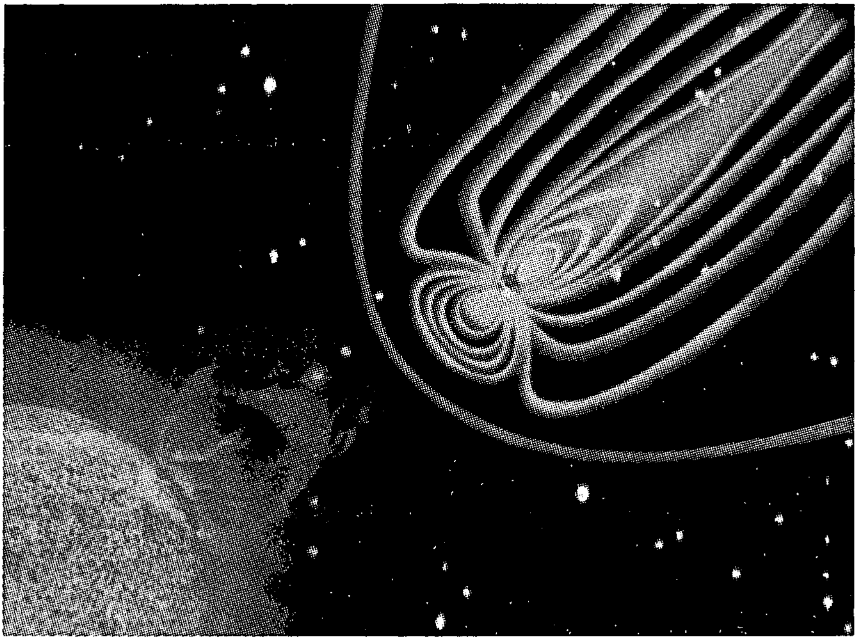

Figure 1

Image courtesy of Robert Winglee

photons emitted by the Sun at 1 AU is approximately 10,000 times greater, explaining why solar sails have received so much more attention than magnetic sails. A magnetic sail must be enormous to obtain significant thrust from the solar wind. Robert Zubrin, in a paper published in 1993,[4] studied the feasibility of magnetic sails. His conceived system, which had a mass of several metric tons, consisted of a superconducting ring 100-200 kilometers in radius, obtaining accelerations only on the order of 0.01 meters/second^2. The system was technically and economically infeasible.

The M2P2 concept overcomes the technical and economic obstacles of magnetic sails by creating a mini-magnetosphere, or magnetic bubble, around a spacecraft through electromagnetic processes rather than mechanical structures. With a relatively small input of energy and ionized gas, this artificially created magnetic bubble can grow to an adequate size to act as a sail and receive an appreciable push from the solar wind.

The term "magnetosphere" refers to the region surrounding a planet containing ionized particles controlled by the planet's magnetic field.[5] These ionized particles arise when x-ray and ultraviolet radiation from the Sun heats the upper atmosphere of the planet, stripping negative electrons off atoms and leaving positively charged ions. Invisible lines of force, called magnetic field lines, extend between the north and south magnetic poles of a planet. These ionized particles tend to cluster along these field lines in the same way iron filings arrange themselves along field lines of a bar magnet. Left by itself, a planet's magnetic field

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[4] R. M. Zubrin. "The Use of Magnetic Sails to Escape from Low Earth Orbit." *Journal of the British Interplanetary Society*. 46, 3, 1993.

[5] *The International Encyclopedia of Astronomy*, edited by P. Moore. New York: Orion Books; 1987: 240-241.

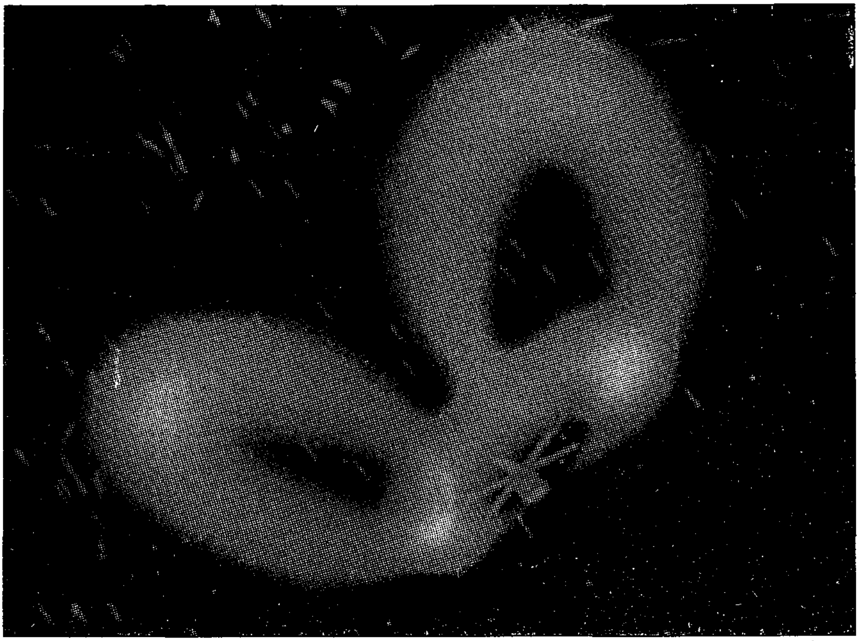

Figure 2 *Image courtesy of Robert Winglee*

would look as symmetrical as iron filings around a bar magnet. The solar wind, however, distorts a planet's magnetic field, compressing the upwind side (in the case of the Earth, to 6-10 Earth radii above the surface) and stretching the field lines on the downwind side into a long tail (perhaps to 1,000 Earth radii for the Earth—no one knows for sure). The magnetosphere is the region within this tear-shaped boundary [see Figure 1]. The magnetosphere deflects most of the solar wind particles from reaching a planet.

A magnetosphere's size and shape is determined by the strength of the planet's magnetic field and the strength of the solar wind. If density and average velocity of the solar wind diminishes, a planet's magnetosphere grows, and vice versa. A planet with a stronger magnetic field will have a larger magnetosphere.

How M2P2 Would Work

M2P2 would create an artificial miniature magnetosphere around a spacecraft by inflating plasma in the presence of a magnetic field [see Figure 2 and 3]. Plasma is a completely ionized gas containing equal numbers of negative electrons and positive ions moving independently of each other. These freely moving ions give plasma high electrical conductivity and allow it to carry an intrinsic magnetic field. Plasma has the property that when it is created in a magnetic field, it acquires the magnetic properties of that field. Plasma physicists refer to this field as "frozen" into the plasma. As the plasma expands outward, it propagates this acquired magnetic field along with it.

The laboratory prototype of M2P2 uses argon gas injected into a quartz tube wrapped with an antenna. The antenna transmits radio waves to heat the gas inside the tube into a plasma state. The tube is positioned in a vacuum chamber surrounded by magnetic coils. The magnetic field is frozen into the plasma, and the plasma is allowed to inflate to the limits of the vacuum chamber walls. In space, this magnetic bub-

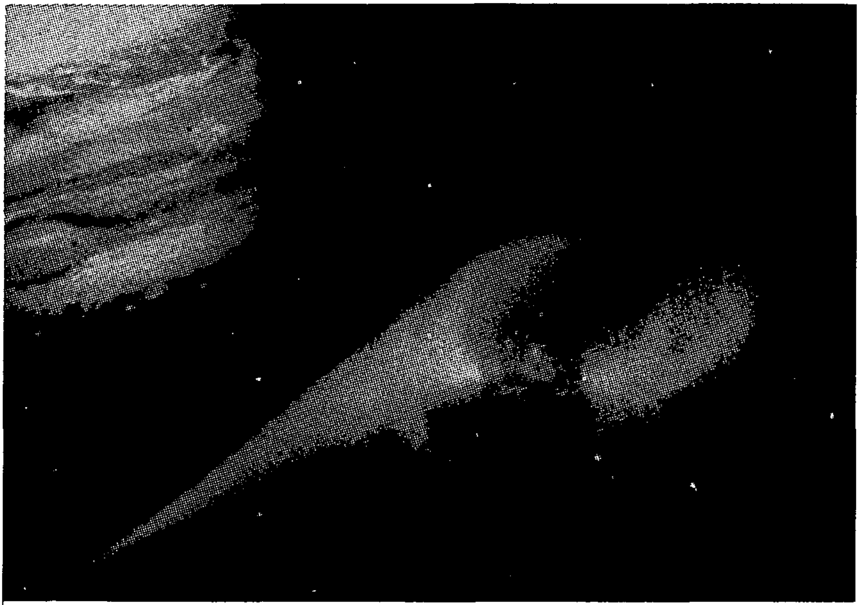

Figure 3 *Image courtesy of Robert Winglee*

ble would expand until the plasma pressure reaches equilibrium with the dynamic pressure of the solar wind, creating a mini-magnetosphere. The solar wind would then push against this mini-magnetosphere like a sail.

Dr. Winglee's concept for a full-scale M2P2 device would produce a magnetic bubble with an enormous cross-section of 15-20 kilometers at 1 AU from the Sun. The M2P2 device would have a mass of approximately 50 kg, not including its power source, payload, or other subsystems. Unlike solar sailing, M2P2 is not truly propellantless—a constant source of gas is required to replenish the plasma that exhausts into space. For the prototype device, however, this amounts to only about 0.6 kg of gas per day.

The prototype M2P2 device would require 1-2 kilowatts of continuous power when in operation to create and sustain the plasma bubble. This power could be provided by solar cells, requiring approximately five square meters of deployable solar arrays per kilowatt. It could also be provided by some other source, such as a radioactive isotope thermal electric generator, like those used on NASA's Pioneer, Voyager, Galileo, and Cassini missions.

A device of this size would produce approximately 1-3 newtons of thrust, barely equal to the weight of a small paperback book on Earth. As with solar sailing, however, this force can be sustained over many days, weeks, or months of acceleration. Over a three month period, such a device could change the velocity of a spacecraft with a 500-kg initial mass (within the range of many planetary probes deployed by NASA in the past) by up to 50 kilometers per second (112,000 miles per hour), expending only 54 kg of gas in the process, and enabling fast, direct trips to the outer planets, or out of the solar system.

Unlike solar sails, thrust generated by M2P2 devices would stay nearly constant irrespective of distance from the Sun. As the spacecraft travels farther away from the Sun, the size of its mini-

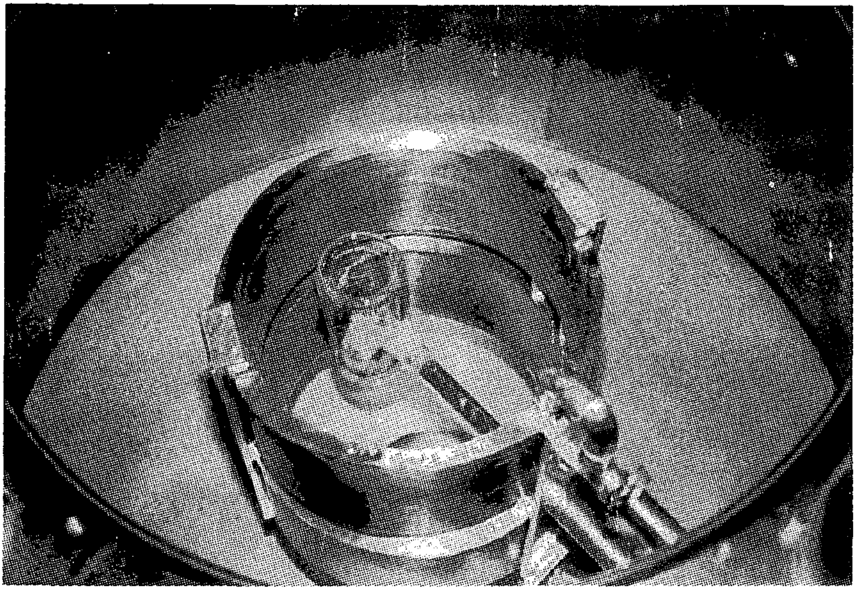

Figure 4 *Image courtesy of Robert Winglee*

magnetosphere would expand by the same proportion as the solar wind density would diminish, in the same way a planet's magnetosphere expands when solar wind density decreases. Of course, if the spacecraft relies on solar cells to power the M2P2 device, the available electrical power and size of the sustainable magnetic bubble (and therefore, thrust) will decrease further away from the Sun. For deep-space missions, using nuclear energy sources would overcome this obstacle.

By altering the properties of the magnetic field, the M2P2 device can accelerate or decelerate the spacecraft with respect to the Sun, like a sailboat tacking in the wind, to achieve the desired course. In this respect, an M2P2 spacecraft would have much more control over its course through space than a hot-air balloon does riding terrestrial winds. The mini-magnetosphere has the added advantage of protecting the spacecraft from harmful particle radiation, such as radiation from solar flares, just as the Earth's magnetosphere protects us.

How Does M2P2 Compare to Other Propulsion Technologies?

How does M2P2 stack up against other advanced propulsion technologies? The advantages of M2P2 over solar sailing and chemical rockets were discussed earlier. M2P2 also compares very favorably with ion drives, the most efficient of all available rocket engines, which generate thrust by electrically ionizing a gas and electromagnetically accelerating it through a nozzle. Like M2P2, ion drives generate very low thrust over very long time periods rather than high thrust for short periods. Ion drives are currently used on some modern commercial communication satellites to maintain their positions in geosynchronous orbit against drift caused by lunar and solar gravity. In 1998, NASA launched the Deep Space 1 mission, successfully testing an ion drive as the principal propulsion system for a robotic space probe.[6]

To compare M2P2 to ion drives, we need to define a numerical measure of a rocket engine's efficiency. To measure

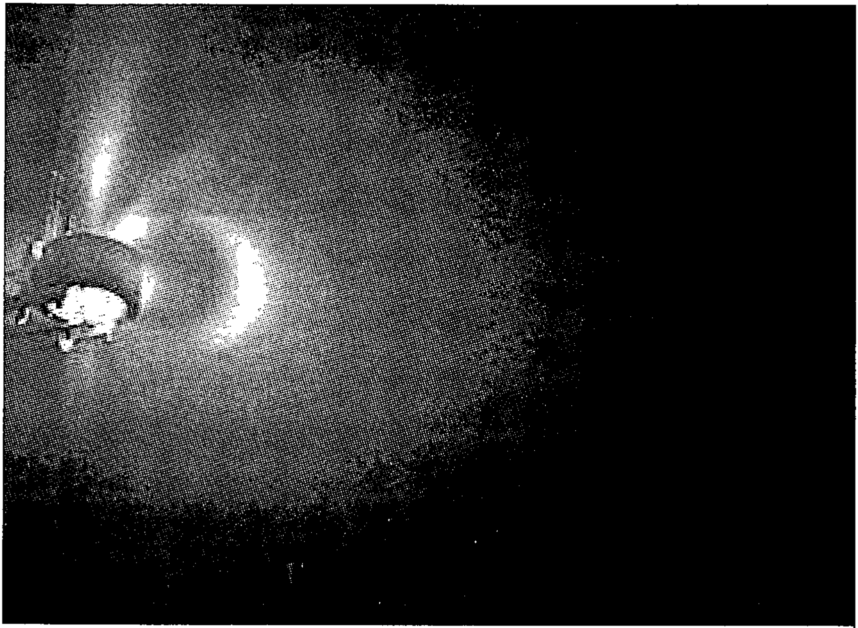

Figure 5 *Image courtesy of Robert Winglee*

the efficiency of a rocket engine, aerospace engineers frequently use a term called "specific impulse," a measure of the impulse content of propellant, which can be thought of as the number of seconds one pound of fuel can deliver one pound of thrust. The most potent chemical rockets in the world (such as the Space Shuttle's main engines), utilizing liquid hydrogen and liquid oxygen propellants, have a specific impulse of 450 seconds.[7] Deep Space 1's ion engine is considerably more efficient, achieving a specific impulse of 3,200 seconds.[6] Theoretically, advanced power systems could result in ion engines with a specific impulse as high as 6,000 seconds.[7] But M2P2 would trump them all, achieving a specific impulse in the mind-boggling range of 20,000-40,000 seconds.

We can also compare the input power and resultant thrust for an ion engine and M2P2. Deep Space 1's ion engine required 2.3 kilowatts of power to produce a maximum thrust of only 0.092 Newtons.[6] The prototype M2P2 device would require 1-2 kilowatts of input power to deliver 1-3 newtons of thrust—up to 32 times more thrust for less electrical power input.

Developing the M2P2 Prototype

Over the last three years, Dr. Winglee and his team at the University of Washington have been developing a prototype of M2P2 in a laboratory setting, funded by grants from NASA.[8] Using a 1-meter diameter vacuum chamber, the team has successfully used the prototype to create plasma and inflate a magnetic bubble to the desired geometry within the confines of the chamber [see

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[6] M. Rayman, et. al. "Results from the Deep Space 1 Technology Validation Mission." *Acta Astronautica 47 (2000).*

[7] R. Sackheim, R. Wolf. "Space Propulsion Systems." *Space Mission Analysis and Design*, 2nd edition, edited by W.J. Larson. Torrance, California: Microcosm; 1992: 644.

Figure 4]. All characteristics of the inflated plasma have closely agreed with predictions generated supercomputer models. The team is now conducting experiments using a new, larger chamber at the University of Washington, with a test volume ten times greater than the original prototype.

In 2000, the team conducted a test at the NASA Marshall Space Flight Center, using a 32' x 20' vacuum chamber. These tests resulted in creation and expansion of magnetic bubbles over 16 feet in diameter. The NASA test chamber results closely mirrored the 1-meter chamber results at the University of Washington, but on a larger scale [see Figure 5].

All indications are that in the absence of test chamber walls (i.e., in space), the prototype would produce mini-magnetospheres that would inflate to 15-20 kilometers in cross-section, adequate to satisfy the operating performance requirements of a full-scale device on a real space mission. No in-space demonstrations are funded yet, but the team has the ultimate goal of a full-scale demonstration on a space mission. A potential source of funding for a future in-space demonstration is NASA's New Millennium Program, which focuses on speeding up space exploration by validating advanced space technologies on real missions. The New Millennium Program funded the Deep Space 1 mission validating the first ion drive, for example.

Speculations for the Future

If M2P2 works according to expectations, what will it mean for the future of in-space propulsion and planetary exploration? Here, we must leave the arena of scientific fact and launch into educated speculation.

First, it is important to realize the limitations of M2P2. M2P2 is strictly a technology for deep-space propulsion. Conventional means, such as chemical rockets, must still be used to launch an M2P2-driven spacecraft off a planetary surface and beyond a planet's magnetosphere. Only then can it catch the free-flowing solar wind.

M2P2 devices would not be very effective in deep interstellar space either. Although the solar wind does not experience significant deceleration within the solar system, it does decelerate significantly when it crosses the "heliopause," located at 80 AU (± 10 AU). The heliopause is the boundary of the Sun's magnetosphere, where the Sun's magnetic field and solar wind give way to the interstellar medium. At the heliopause, the solar wind hits the interstellar termination shock, abruptly transitioning from supersonic to subsonic flow and reducing its velocity by at least an order of magnitude.[9]

Before it reaches the heliopause, however, an M2P2-driven spacecraft using a non-solar electric power source can attain incredible velocities of up to 800 kilometers per second (1.8 million miles per hour), limited only by the maximum velocity of the solar wind inside the heliopause. Beyond the heliopause, the spacecraft can coast through the cold depths of interstellar space before passing through the heliopause of another star system and turning on its M2P2 drive once again to decelerate. Such a spacecraft would zip across a light year in 375 years, a speed inconceivable with any other propulsion system using technology foreseeable in the next century.

Within the next century, we can imagine interplanetary spaceships with hu-

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[8] For up-to-date information on the M2P2 project at the University of Washington, go to: www.geophys.washington.edu/Space/SpaceModel/M2P2/

[9] J. Slough. "High Beta Plasma for Inflation of a Dipolar Magnetic Field as a Magnetic Sail." Presented as paper IEPC-01-202 at the 27th International Electric Propulsion Conference, Pasadena, CA, 15-19 October 2001.

man passengers using ion or chemical drives for propulsion within a planet's magnetosphere. Outside a planet's magnetosphere, these spaceships would turn on M2P2 drives to cross the distance between planets or stars. The two different propulsion systems could serve as useful backups for each other. Such spaceships might be powered by fission reactors or fusion reactors, capable of generating megawatts of electrical power for their ion drives or M2P2 drives. The magnetic bubbles produced by these spaceships would be hundreds of kilometers in cross-section, generating hundreds of newtons of thrust from the solar wind. The same inert gas (such as argon or xenon) could be used as the propellant for the ion drive and to generate the plasma for M2P2. However, M2P2 can turn a variety of other propellants into plasma, including liquid hydrogen, nitrogen, methane, or even water. This flexibility of M2P2 propellant source enables refueling in space or from planetary atmospheres.

M2P2-equipped ships would be able to regularly zip between Earth and Mars in as little as 1-3 months depending on the alignment of the two planets. By comparison, the best chemical rockets can do is a six month transit time, provided the launch occurs inside a window of a few weeks' duration that opens once every two years. Outside of this launch window, transiting from Earth to Mars is not even feasible with chemical rockets. Earth to Jupiter or Saturn would take 1-2 years, compared to 5-7 years with chemical rockets. Once in the Jovian system, the M2P2 could be used to protect the ship and its passengers from the deadly radiation of Jupiter.

Perhaps M2P2's greatest potential lies in opening up the space frontier beyond the outer planets, to the ring of icy planetesimals in the Kuiper Belt. Astronomers speculate that in our solar system there exist between 10^8 and 10^9 comets between 35 and 45 AU. Between 45 and 1,000 AU, there may be as many as 10^{13} comets, with a total mass equal to several hundred Earths.[10] Missions to the Kuiper Belt are inconceivable with chemical rockets and difficult even with ion drives. M2P2 makes missions to this little-understood region of space conceivable within a relatively short mission timeline of one or two decades.

A Promising Future

In 2001, Discover Magazine honored Dr. Winglee with an Innovation Award. Space.com founder Lou Dobbs presented the award, commenting, "This technology may enable us to establish a permanent presence in space, something existing technologies will not allow us to do."[11]

The M2P2 concept, a space age version of hot-air ballooning, is elegant in its simplicity. Early laboratory experiments have produced encouraging results, and hopefully, a full-scale prototype will be deployed in space in the coming decade. ■

About the Author

Gary Lai holds a B.S. degree in Applied Economics from Cornell University, and a B.S.E. degree in Aeronautical and Astronautical Engineering from the University of Washington. His diverse background includes positions as a medical researcher in radiosurgical treatment of brain disorders; as the Chief Financial Officer of a company; as a rapid prototyping technician for NASA; and most recently, as a Systems Engineer for Kistler Aerospace Corporation, a company developing a reusable launch vehicle. He is currently an aerospace consultant and freelance writer living in Seattle, Washington.

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[10] Ibid.

[11] R. Lloyd. "Solar Windsurfing: The Fastest-Ever Propulsion." Posted on *Space.com*, 21 June 2001.

Private Eyes

Grey Rollins

Any technology that *can* be abused
will be abused. . . .

"I hear you're hard to kill."

I shrugged. "I die as easily as any man. It's *keeping* me down that's the problem. I have this nasty habit of rising from the dead."

Bruce Masters had on a jacket that was supposed to impress me with how much money he made. Black with iridescent moiré patterns, glittering brass buttons, shoes to match; the trousers were royal purple with razor sharp creases. I was sure he cut a fine figure in the night clubs, but to me he looked more like a clown. He was giving me a cold, appraising eye; probably didn't like the cut of my clothing either.

"Rising from the dead, huh? You religious?"

I shook my head. "Not so that you'd notice. Religions are tautologies. Of course their god exists, elseways the world wouldn't be here, so the fact that the world is here proves that their god exists. Round and round in circles. No denying that it works for some people, but all it takes is Toto pulling back the curtain to ruin a good story."

"Tautology? Isn't that a rather big word for a fellow like you?" he asked.

"If you prefer, we can settle on the phrase circular logic, but I'd rather use the right word for the occasion."

My guest shook his head. "All this and the man throws in Oz, too. Must be my lucky day."

"Glad I could help. Now, what's on your mind?"

"It's like this . . . you've heard of SynthesEyes, right?"

"Artificial eyes."

He nodded, pleased that I'd heard of them. "Second biggest artificial eye manufacturer in the world. We make eight basic kinds of eyes. Something you may not have realized is that not all of our eyes go into people. Some go into industrial robots, for instance. But the important thing for the moment is that there's not just one eye for humans, there are two."

"Yeah, left and right."

He gave me a strained smile. "I trust you're displaying a sense of humor."

"Humor keeps me human."

His smile turned thin and hard. "I can see that it's an uphill battle. No, the two models of eyes have different spectral responses. The consumer model responds to visible light in pretty much the same way that your own eyes do. The second model employs proprietary technology to extend the response into the infrared and ultraviolet regions."

"IR . . . night vision . . . military use," I mused, thinking aloud.

His eyes narrowed. "Okay, so maybe

you aren't as stupid as you act. Yes, military, SWAT teams, that sort of thing."

"And the UV?"

He shrugged. "We throw it in. Some people use it, some not. There are things you can see in UV that you can't see in visible light. Gives them the option of seeing secret messages or whatever. We call that model the Private Eye."

I raised one eyebrow. "And you criticize *my* sense of humor?"

He had the grace to blush. "Uh, well, blame the marketing department. I think it's kinda hokey, myself, but catchy names help things sell."

"Indeed. So I take it that the problem is related to these, uh, Private Eyes."

"Not directly. Our head researcher, Dr. Straker, was in a car accident and is now paraplegic as a result."

"Is there some reason not to grow Dr. Straker a new body?" I pinched the skin on my forearm. "Works for me."

He got flustered. "Therein lies the rub. We started to do exactly that, of course. But there was a bit of a holdup in getting the new body ready. Several holdups, in fact. Before all was said and done, six months or so had passed, and in the meantime Dr. Straker had . . . well . . . developed an addiction."

"An addiction." Like a shrink, I sometimes found that it worked well to simply repeat what someone had said, prompting them to fill in the blanks.

"You may not have heard of it before, but there's a condition called synesthesia."

I nodded. "Hearing colors, smelling textures—crudely put, the senses are cross-wired so that synesthetes might not only hear a musical note, but associate it with a specific color, for instance."

"Yes. It occurs naturally, but it's now possible to surgically rewire the brain to route any given sensory input to another part of the brain. It's only a rough approximation of naturally occurring synesthesia—if you reroute the ears to the seeing portion of the mind, you'll *only* see sounds—you'll no longer be able to hear at all. At least not in the conventional sense. Some people have had the operation as a form of thrill-seeking."

I nodded, remembering an article I'd read. "Seems I recall seeing something about a guy who had his hearing rerouted. They kept having to run him off from airport runways and construction sites—loud places. He kept wanting to 'see' the sounds. Eventually, he went deaf from cumulative damage to his ears, so that was the end of that. How does this relate to Dr. Straker?"

He shook his head sadly. "There was quite a bit of damage in the accident, and the pain, it seems, was intense. Drugs were of little use. As near as we can tell, Dr. Straker became desperate and—"

"Had his senses rewired. What . . . pain to the pleasure centers of the brain?"

He nodded. "Unfortunately, yes."

"So now you've got a very, very dedicated masochist on your hands."

"The parts of town where one goes to satisfy that sort of hunger aren't exactly the best sorts of places."

"And you fear that Dr. Straker might have fallen in with some undesirable characters and perhaps they're using the leverage the masochism gives them to put your technology at risk."

He nodded unhappily. "Exactly."

"You can't just undo the operation?"

"It's illegal to force an operation on someone, even for their own good. Dr. Straker doesn't want to undergo the reversal, nor does she seem to want to get into her new body. Our hands are tied."

"Interesting."

"I'm glad you think so. Naturally, we'll want this kept quiet. That's why we came to you instead of going to the police."

"Naturally."

"Can you do it, Sawyer? Can you get Dr. Straker free of these people?"

"Yes."

"Hopefully you won't need your ability to rise from the dead."

"Let's hope not. It's a nice parlor trick, but I wouldn't want to do it every week."

A good single malt Scotch can ensnare the senses in much the same way as fine wine. Color, aroma, flavor components, they're all there. I had my feet on my coffee table, next to a bottle of Macallan. Not my favorite, but still a tolerable dram.

Since my rebirth in a cloned body two years previously, I had restructured my life almost from the ground up. Changed jobs—you can hardly stay at a company after you have your boss thrown in prison. Whistle blowers may get a certain amount of moral satisfaction out of what they do, but the cold, hard fact is that they are unlikely to climb much further up the corporate ladder. So I'd hung out my shingle as a detective. Why not? It wasn't that far removed from my previous occupation investigating suspicious claims for an insurance company.

Having been killed in the line of duty, I'd been reincarnated in a cloned body. It was everything they'd claimed. Colors were brighter, accumulated aches and pains had vanished, no scars . . . it was a wonderful new introduction to life. I had an adult's experience and sophistication, coupled with a brand new chassis.

I'd also acquired something else along the way.

"Want to bet on whether the 'bit of a holdup' Dr. Straker's replacement body experienced was, shall we say, artificial?" my terminal asked.

"You won't find a taker here. I'd say it's a sure thing. But to condemn someone to endure pain like that for months on end just so you can get your hooks into them . . . that's a level of cruelty above and beyond simply pulling the wings off of flies."

"The difference being that flies deserve it. Especially those fat, black ones that circle around the room for hours on end, making big, buzzy slalom runs around the lamps on the end tables."

I chuckled. "You're a cruel bastard. Good thing you're in there and I'm out here."

"Ah, but I'm you, and everything I feel is what you feel."

"Sad, but true," I confessed. "And it's the fact that it's true that makes it sad."

While I'd been stored on a computer chip waiting for my cloned body to reach maturity, I'd discovered how to copy myself through the net. Now, not only was there a 'live' copy of me sitting on the sofa, but there were more copies of me stored around the network. Not just backups, mind you—these were conscious, living, free-range copies. As far as I knew, no one else had ever managed that stunt. That there were active copies of me still within the system was a secret between Me, Myself, and I. And I knew that I wouldn't tell.

The copy currently in my terminal was regarding the Macallan with envious eyes. "I don't suppose you'd mind dripping a bit of that into the keyboard, would you?" he said.

I looked at the bottle, the keyboard, and back at the bottle. "One of us has to be the designated thinker tonight. You're it."

With a theatrical sigh, my counterpart forced his eyes away from the bottle. "There are times when I hate logic."

"Yeah, me too, but it's the only weapon we've got when you get down to it. I guess the first thing to do is to talk to Dr. Straker. It wouldn't hurt to try the power of sweet reason," I said.

"Logic, I fear, will not prevail against those ramparts," the terminal said. "They are built too sturdily. Addiction does not succumb to reason."

"Probably not," I admitted. "But if persuasion fails, then perhaps I can find out who did the operation."

"Might as well go for the gold and ask whether someone's blackmailing her."

I blinked. "*Her?*" There are times

when I think I should take in my shingle as a detective. Belatedly, I realized that Masters had referred to Dr. Straker using the female gender, but for some reason it had slid past me like a greased eel. Fortunately my digital alter ego didn't know that. I'd never hear the end of it.

"You were going to find out sooner or later. I was tempted to let you walk in blind and let you make a fool of yourself, but I decided that it would reflect poorly on us . . . more particularly, me."

"And pride is all."

"It is when you're trapped in the system looking out. At least you can play touchie-feelie if the opportunity arises. All I can do is watch."

"You wouldn't dare!" I protested, and even to my ears it sounded weak.

"No comment."

"You already have?"

"No comment."

"Blast and confusticate you, you confounded machine! I'll not have you skulking around in my private life without my permission."

"That's *our* private life, you overgrown pulsating protoplasmic protuberance. Don't forget that I'm you, and you're me, and we're both up a tree, stuck with each other. You get your kicks your way, and I'll get mine my way."

I frowned sulkily at the terminal and made a big show of savoring the last sip of Scotch in my glass. At least I could win the battle, if not the war.

As the terminal had said, I was bound to find out sooner or later. Might as well make it sooner. I rang the bell to Dr. Straker's apartment the following morning and waited, trying not to form preconceived notions as to what I'd see when the door opened.

"Who is it?" a muffled voice called through the closed door.

"My name is Sawyer, Jack Sawyer. I'd like to talk to you for a few moments."

"What are you selling?"

"I'm not selling anything. Besides, the building is brick—doesn't look as though you need vinyl siding."

I thought I heard a short laugh on the other side of the door. A chain rattled, and the door opened a handsbreadth. "Hang on a second. Let me back away from the door."

I nudged the door open slowly, peering around the edge. Dr. Straker was maneuvering backwards in a wheelchair, headed for a large empty space in the center of the living room. "Come on in," she called over her shoulder.

Once upon a time, she'd been attractive. Not stunning. Not fashion model. But well worth a second look and very likely a third. Now, the woman sitting in the wheelchair was withered from the waist down and scarred from the waist up. If Masters was correct in his suspicions, she probably had scars on her psyche, as well.

Her apartment looked as though two different people lived there. The art on the walls and the furniture were elegant and functional, something just short of the Neo Danish Modern look. But there was a tremendous amount of clutter in certain areas of the room—mostly those within arm's length of where the wheelchair could easily get. The corners and such were still pretty clean. Looked as though Straker had undergone a rather abrupt personality change once she'd found herself confined to the wheelchair.

She saw me taking in the condition of the room. "I don't get much cleaning done these days." She didn't sound very apologetic.

"Oh, rats . . . *House Beautiful* will be so disappointed when I tell them to cancel the photo shoot."

She gave me an odd look. "You call that a sense of humor?"

"Yeah. Pathetic, isn't it? It developed after I got into my cloned body. I was thinking of demanding my money back, but decided to learn to live with it."

"A cloned body, huh? Then you're from the body company?"

I shook my head. "No."

She didn't seem to hear. "I mean I know you've been holding the body for me, but I—"

"I'm not from the body people, Dr. Straker. It's Saturday. As far as I know, they don't make house calls, and almost certainly wouldn't do so on a weekend."

"Then who are you?"

"Jack Sawyer, like I said."

"No, I mean who *are* you?"

I thought about giving her my family history, in the fine old Southern tradition of getting to know one another, but I didn't think it'd go over well. She was getting worried and a bit angry.

"I'm a detective. I'm here to find out if you're in some sort of trouble."

"Detective? Trouble?" She clearly hadn't expected that answer out of all the possibilities. "What kind of trouble am I supposed to be in?"

"You're in a lot of pain. That's not a good position to be in."

"My pain is under control and I'm not sure I want strangers prodding around in my personal life."

Me, a stranger? Perhaps I should reconsider telling her about my family. "There are concerns that you've chosen to control your pain in unorthodox ways, and that's led you into situations where you could be . . . compromised."

Her eyes narrowed. "*Whose* concerns? I tell you, my life is under control!" She was working her way towards full-blown anger.

"Dr. Straker, I—"

"It's Bruce, isn't it? Bruce Masters. He sent you."

I stood silently, letting her work it through.

She bit her lip. "Bruce should know better than to worry about me. I've been productive. He has no right to complain about my work."

"It's not your work he concerned with. As far as I know, he's happy as a clam with your work."

"But what then?"

"Your safety. Your health."

"I'm fine."

"That's what they all say."

She took a deep breath and exhaled noisily. "Look, tell Bruce that I'm fine. Tell him that if I need help I'll ask for it."

"By the time you realize you need help, it may be too late to ask for it."

"What kind of melodramatic crap is that? Are you going to tell me an overdeveloped sense of theater came along with the cloned body, too?"

"No, the melodrama comes from the old me."

"Well, I don't like it, and I don't like you. Now, get out!"

Mustering what dignity I could, I slid a card onto the end table nearest me. I didn't bother telling her to call if she needed me. She'd probably think it was just another melodramatic cliché.

I was already closing the door behind me when I heard her ask in a much softer tone of voice, "Your body . . . do you like it?"

With the door at half-mast, I turned and looked at her for a full thirty seconds before responding. "Yes. I like it a lot. I won't say that it was worth going through what I had to go through, but it's even better than I'd heard it would be." Without waiting for her reply, I closed the door softly and left.

As I made my way down the steps to my car, I was shaking my head. Dr. Straker hadn't exactly thrown herself at me. Clearly, I'd have to work on my sex appeal.

My terminal was already lit when I walked in. A bad sign. It meant that my software doppelganger was impatient for news, and he could talk a whole lot faster than I could. That can get annoying.

I made a preemptive first strike. "Okay, okay . . . I confess. She was begging to be my love slave. It was all I could do to keep her from ripping the clothing from my body and having her way with me."

The terminal wore a frankly skeptical

look. "Was it a nice dream?"

I shrugged. "Anything to enrich my life."

"Try reality," the terminal said. "It's much more substantial fare than those empty fantasy calories."

"All right," I countered, "try this on for size. She more or less admits that she's had the surgery. The way she phrases it is that her pain is 'under control.'"

"But doesn't say how."

I shook my head. "No, but the inference is clear."

He shook his head in turn. "Weak. Very weak. Wouldn't fly in a court of law."

"I know, but I had to try."

"And you are nothing, if not trying."

"I'm well aware of my character failings."

"Just making sure."

I glared at the terminal. "Basically, she's got the standard addictive personality. She's got what she feels is a valid excuse to pursue the synesthesia. She's hooked on it. She thinks she's got it under control instead of *vice versa.*"

His image nodded. "Yeah, that's what they all say."

I closed my eyes and leaned back in my chair. "I know. She probably feels that she can stop any time she wants to, the whole nine yards."

"So who are we to knock this fragile balancing act she's got going?"

I opened one eye. "For one thing, we're getting paid to do exactly that. If we don't jog her elbow, we won't make any money. For another, it's not healthy or normal to sit in a wheelchair and get your thrills from pain when there's a newly cloned, healthy body waiting down at the clinic, all set to go."

"Keeping that body in limbo like that has to be costing her money," he mused.

That triggered a train of thought. I grunted and said, "And what do you suppose she'll do when she runs out of money?"

"Drop the maintenance fees on the body," the terminal replied promptly.

"And if she truly does have a problem with masochism, she's probably burning money on the wrong side of the tracks when she goes to get her kicks. When push comes to shove, she'll have to choose between pleasure and that pesky maintenance fee."

"The body goes in the trash bin, and she spends her last dime on illicit thrills."

"This is not a good scenario," I noted sourly.

"What about the hypothetical pressure she's getting to reveal corporate secrets?"

Drumming my fingertips on the arm of the chair, I mulled that one over a minute or two. "Can you check her phone line to see if she's made any calls since I left?"

"Sure. Give me two shakes of a bunny's tail," the terminal said.

One of the nifty things my computer cousin could do was comb databases for information. It took more than two shakes of a bunny's tail—more like ten or twenty—but I was in no mood to complain when he was able to do research in less than three minutes what would be difficult for me to accomplish in an entire afternoon, if at all.

"Yep," the terminal said finally. "She made a call. I've got the number and, yes, before you ask, I've got the name and address."

"But . . ." I prompted, sensing that there was another shoe to drop.

"I rang the number and no one answered."

"So there's no reason to drop by and see what manner of creature lives there."

"Unless . . ." His turn to prompt me.

He was ahead of me. "Okay, I'll bite. What am I missing?"

"What if the reason no one is home is that they're over at Dr. Straker's place?"

"*Ah!* A hit. A palpable hit."

"One of us has to pay the bills," my

terminal said, and promptly shut itself off before I could come up with an appropriate comeback.

The rascal loves to do that.

It was raining as I drove back over to Dr. Straker's apartment. A steady, unwavering attempt on the part of the clouds to cleanse the streets. I didn't bother telling them it was wasted effort, as I was actually rather relishing the snug, warm, protected feeling that came with being in a man-made cocoon capable of holding the elements at bay.

I parked where I could see the door to Dr. Straker's apartment and turned off the engine. Within ten minutes my windows had fogged so badly that I wouldn't have been able to see a Yeti doing handstands on the hood. I sighed, wiped the window with my sleeve and settled back into my huddle. The next time the window fogged—even more quickly than the first time—I cracked the window. The window grudgingly cleared, but rain was coming in the crack, soaking the carpet in my car, and I was rapidly getting cold. So much for keeping the elements at bay.

At ten that evening, I gave up and went home.

The damp carpet in my car smelled rather unpleasant.

The next morning, I had the terminal call the number again. A man's voice answered. Anyone else would have simply hung up at that point, but my practical joker of an alter ego switched to a woman's voice and went into a spontaneous spiel about how if his mortgage payments were too high, we could help him lower his payments. In the process, we could consolidate his other debts into one easy, low monthly payment. After about thirty seconds of the unrelentingly cheerful patter, the guy hung up.

"What would you have done if the guy had said, 'Sure, sign me up,'" I groused.

"I would have opened an account, deposited the money, then withdrawn it as soon as his payment cleared and closed the account. I'd buy myself a new terminal and you . . . well, maybe I'd get you some new shoes. Those are looking distinctly worn."

"Just make sure you get gumshoes."

"Ha, ha. Just for that, I'll get something used at a pawnshop. Something that creaks as you walk."

"Since you're in such rare form today, how about helping me decide whether to pick up where I left off last night with Dr. Straker, or try my luck with this mystery guy."

"Mystery guy has a name, by the way," the terminal told me.

"And that would be. . . ?"

"Dr. Herbert Longchamps."

"I think I'd have to turn in my gold-plated, signature model .357 Magnum if I didn't go see what kind of a face is attached to a name like Herbie Lambchops."

"You have a way with words," the terminal said acidly. "And after you've had your way with them, they usually call the authorities and report you for assault."

"Wise guy. Let's see you turn up something, if you're so smart."

"Ask, and it shall be done."

The terminal dialed Longchamps again and said, "Good morning, sir. We're conducting a survey for the local telecommunications network. We wanted to know if you would be interested in a service which would allow you to connect your work and home phones together." What followed was such a mishmash of bafflegab that I was certain that Longchamps had no idea what the putative survey was about. I know I was confused.

Somewhere in the conversation, the terminal wheedled him out of his work number so as to see if it was 'compatible with his home number.' Clearly out of his depth, he gave the number. I kept expecting him to hang up the same way that he had with the bogus refinancing call, but he surprised me by staying on the line and more-or-less willingly giving the requested information. A stunning performance on the part of my terminal. I felt smug in reflected glory. After all, he was me.

When the terminal hung up I asked, "What? You couldn't just look his work number up in the directory?"

"Unlisted. Which I think you'll agree is a bit out of the ordinary for a business," he noted. "There were several ways I could wheedle the number out of the system, but this was more artistic."

I rolled my eyes. "Artistic! Next you'll be opening a one-computer show at the local art gallery. A row of framed mug shots, no doubt."

"You think that was something? Watch this."

Within minutes, the terminal had tracked all calls into and out of Longchamps's office over the last month. There were quite a few and it was going to be a nuisance trying to get information on all of them.

Best to let the terminal handle that part. I'd handle the dirty work staking out Straker.

Mist was falling. The car windows had been reduced to the equivalent of frosted glass by the moisture. The temperature was in the upper thirties and I was miserable. Again. Clearly, real-life detectives don't spend all their time fending off over-sexed women. At least some of the time they suffer. Balances the books on some cosmic level, I suppose. The way I figured it, I was *way* overdue to be ravaged by an entire tribe of lonely women. At least one, anyway, if it wouldn't be too much to ask.

The windows of Dr. Straker's apartment were luminous rectangles painted by a pointillist. I wondered if Seurat had gotten his inspiration from misty windows. At intervals, a few drops would join and run down the windshield, giving me the illusion of being able to see for a moment. Not that it really mattered—from where I was parked, I couldn't see much anyway. I was bored. Pretending that her lit windows were the eyes of a jack-o'-lantern didn't help. I realized I was running out of ways to amuse myself when I found myself doodling smiley faces in the foggy places left by my breath on the side window. Worse yet, sooner or later someone would notice the spontaneous generation of faces and begin to wonder what was going on.

Sometime around nine, I was getting ready to give up for the evening. I had my key in the ignition, ready to turn, when the door opened and Dr. Straker wheeled herself out. It was obvious that she hadn't had enough practice to get graceful with her wheelchair. Or perhaps she simply didn't care. Watching her awkwardly lean forward to close her door made me so uncomfortable that I nearly leapt forward to do it myself. I managed to restrain the impulse. It would be difficult to explain how I happened to miraculously materialize out of the mist.

She made her way down to her car by inching slowly across the sloping grass rather than attack the concrete steps. Getting into her car was even more painful to watch. When at last she started her motor and backed out of her parking space, I admit to being relieved. She must have had hand controls installed, since she couldn't use her feet, but it hadn't even occurred to me to peer through her car windows to see. I'd assumed that she'd take a cab if she wanted to go somewhere.

She was easy to follow. It helped that I already had a rough idea where she would go.

"You didn't even look though the windows?"

"No."

"Wimp." My doppelganger sounded disgusted with me.

"The windows were probably twelve or fifteen feet off the ground. I can't jump like a basketball player . . . and even if I could, a head bobbing in and out of sight outside a second floor window would be likely to attract attention."

"Kick the door in. Go to her rescue. Knight in shining armor and all that."

"She drove herself there. Setting aside the possibility that they set up some kind of mind control when they rewired her brain, I think it's likely that she wanted to be there. She probably wouldn't have viewed my kicking in the door as a rescue."

The image on the terminal frowned. "Second floor, huh? How'd she get up there?"

"They were expecting her. Within a minute or two of her parking her wheelchair at the bottom, somebody came down and got her. Bumped her chair backwards up the stairs."

"So what'd the guy look like?"

I raised an eyebrow. "I hereby accuse you of sexist prejudices. You're assuming it was a man. How do you know it wasn't a woman?"

"All right, I stand corrected. Tell me about the woman."

"Woman? Are you kidding? A woman wouldn't be strong enough to do that." I ignored the glower coming at me from the screen. "He was about six-two, built like a pint-sized Paul Bunyan. Dark hair. More than that, I do not know. It was dark and misting and I couldn't get all that close without them wondering if they had an unannounced customer."

"Be something if he had let go."

"Messy," I agreed. "Besides, that would be the end of our case. By the time Dr. Straker bounced all the way to the bottom of the stairs, she'd probably be dead."

"Yeah, but just imagine the smile on her face."

I shook my head in disgust. "You're incorrigible."

"Want to hear a good one?" my terminal asked.

It was the next morning. Still cold, but not cold enough to snow. No longer just pretending to rain now; it was coming down in earnest. I was trying to think of excuses not to go out in the weather. "Sure, tell me a good one."

"The address of that place Dr. Straker went last night?"

"Yes?"

"Bet you can't guess who owns it."

"The same doctor who rewired her brain. Uh, Longchamps, wasn't it?"

It was worth having to wake up a few brain cells to think about it just so as to see the terminal look that outraged. "No fair! You weren't supposed to guess."

"You asked."

He adopted a sulky expression. "*Huh!* See if I help you any more . . ."

"Don't get your electrons in a spin. Think about it. Here's Dr. Straker . . . a fine, upstanding citizen. Pillar of the community and all that. How's a nice, sweet girl like her going to know where to go for something a little kinky like electric shock or whatever she's got going? Clearly, someone told her where to go. Someone who knew that she'd be heading down that path before long."

My terminal sighed. "All right. When you put it that way, I guess it was obvious. I went to the trouble to slip through the cracks and look at tax records and such, but ended up with the same answer you did."

I shrugged. "Don't worry about it. Just think of it as verification. We would have wanted to check, anyway." I turned and looked at the terminal. "Besides, I didn't know it until you asked the question. Then the answer just sorta popped out."

We were both silent for a few minutes. I was contemplating the rain beating against the pavement outside. There was little else I could think of to do at the moment. At least not without getting cold again, and I was reluctant to do that any sooner than I had to.

"Well, since you're on a roll this morning, how did Dr. Straker get hooked up with this brain switcher, anyway? Same logic you used. He doesn't exactly sound like he's on the up and up. So how did a nice, sweet girl know a nasty character like him?" Then he added, "And don't forget the unlisted office number."

Time to wake up the brain cells again. Hard to get any rest when you're having to think all the time. "It's obvious that he sought her out. Surely a fellow like him has an eye on people going to pain clinics. Then he calls and says that he can help them sidestep the pain."

"All the while knowing that once he turns them into synesthetes, he owns them. They'll develop a thirst for pain and he—kind soul that he is—just happens to know where to send them to get some safe pain."

I nodded, turning back to look at the rain again. "He's the moral equivalent of a pusher. Gets them hooked, then keeps them coming back for more." I then told him about how Dr. Straker had driven herself to the appointment last night.

"If she's had her car modified, then she's planning on staying this way for a while."

"Looks that way. Especially when we know that there's a fresh body waiting for her. She could be in and out in, what, three or four days? She could just leave her car parked, get the new body, and come home to resume her life as a fully competent person. The car would be ready to go when she was."

"Then who's paying to keep the body ready?" the terminal asked. "SynthesEyes or Dr. Straker?"

I shrugged. "Dunno. It would be nice to know. If it's the company, then I guess they're hoping that she'll come to her senses. If it's her, then . . ." An elusive thought crossed my mind. I wasn't quite fast enough to catch it.

The terminal noticed. "What?"

I shrugged. "I lost it. Something about whether SynthesEyes or Straker is paying to keep the body ready."

"They can't hold a body forever, you know. Sooner or later, she's going to have to make up her mind to either stay or go."

"There's something not right here. I can feel it," I said.

"Yep," said the terminal. "That's why they're paying us the big bucks. To sniff out the wrongness."

"There are two things wrong with what you just said."

"And they are?"

"One—it's not all that difficult to smell something rotten here. Hell, Masters already suspected that something was awry, elseways he wouldn't have come to us."

"And the other?"

"The bucks ain't all *that* big."

The only thing I could think of to do was to prod at the doctor, Herbie Lambchops. He was the fulcrum of the thing, and in order to earn my keep, I had to determine whether he had been using Dr. Straker's condition to worm information out of her.

On the one hand, a fellow in Longchamps's position was probably used to just taking the fees he got from the synesthesia operation in addition to whatever he was able to rake in off the back end when his patients—or victims, depending on your point of view—started seeking a little illicit thrill by grabbing a dose of pain whenever they wanted to spice up their lives.

On the other hand, surely he was alert to the idea that every once in a while a patient might come through the door who had a little bit more to offer if they were played right. Bait the hook, dangle it in the water, endure the occasional nibble while waiting for a real hit, set the hook, play out a bit of slack . . . then, when the time was right, start hauling in the fish.

So, was it simply a case of Longchamps getting Dr. Straker hooked on pain, or was he also exploiting her weakness to pry trade secrets from her? The only reason to suspect such a thing might be in motion was because Bruce Masters was worried. Did he have evidence that someone was stealing SynthesEyes's designs, or was he simply concerned about it as an abstract possibility?

I replayed what I could remember of Masters's comments in my mind, but was unable to remember him saying anything about competitors suddenly introducing suspiciously similar products. That didn't mean Dr. Straker wasn't being pumped for information, though. Okay, look at it another way. Would it make any difference in how I approached the case if SynthesEyes's technology was, indeed, being stolen?

Maybe so.

If it was a simple case of Dr. Straker having been addicted to pain more-or-less against her will, then I could handle that in a relatively direct manner. But if Longchamps was getting proprietary information from her, things were more complicated. He didn't seem like the kind of fellow who was in a position to put information like that to good use. He'd have to have manufacturing facilities and a customer base to sell the product to. He looked to be strictly small time. Yet . . . suppose that he had his hands on some good information. He could then sell it to SynthesEyes's competition. That seemed like a much better option. It also brought me square up against the notion that Longchamps might have some heavy backers. Those backers would be understandably reluctant to let go of the goose that laid the golden eggs.

Life could get rough.

It seemed like a good time to take a personality backup.

Just in case.

Herbert Longchamps's office was on Hangst Street, not far from the ice cream shop where I used to buy vanilla nut for an old flame. If it weren't for the pleasant association, I'd have said that it was a less than savory part of town.

The old, red bricks were filthy. The sidewalk in front of the building was filthy. The fellow with the old army coat in the doorway across the street was filthy. It was enough to make me wonder how the ice cream parlor kept its sanitation rating high enough to avoid being shut down.

Longchamps had an office on the second floor. The door was closed. I rapped on it lightly and went through before anyone on the other side could say yes, no, or maybe so. There was no outer office, just the one room with a door off to my right that I assumed led to a small washroom. The desk was large, wooden, and old. It seemed to be a relic of better times. Perhaps Longchamps had once been a respected man in the medical field. Now, he was simply a surprised man looking at me with a slightly befuddled expression.

"Er . . . um . . . may I help you?" he asked.

I didn't really have a game plan. Instinct was all I had to go on, and I had precious little of that. I opened my mouth and switched my tongue to autopilot. "Uh, yes, Doctor, my name is Don Franks and I was talking to someone and they said that you might be able to help me. It's about pain, you see."

He nodded wisely. As the top of his head bobbed in the light coming through the window, I could that he was bald on top and had simply adopted the comb-over to maintain the illusion that he actually had hair. "Ah, pain. Yes, that's my field. Please, have a seat." He gestured towards a visitor's seat.

Since being reincarnated in a new body, I've tended to glide everywhere. It took conscious effort to make my movements a little wobbly—as though I might actually be in pain.

He steepled his fingers under his chin. "So, tell me, what seems to be the problem?"

When all else fails, stick to the truth. I hesitated a moment, looking at the floor, hoping that my acting abilities were up to the task. "I, uh . . . well, I was shot. It was very, very painful." I didn't see fit to mention that the bullets had stayed behind in my old body. It might prove distracting.

He raised his eyebrows. "Shot. Hmmm." He sat and pondered for a moment. "And I presume that you have explored more, ah, conventional methods of pain management."

I nodded. "If I get strong enough drugs, it helps, but then I'm so dull-witted that I can't get out of the chair, much less keep a paying job."

"And what do you do for a living?"

"Data acquisition technician." A private eye is a data acquisition technician in the same sense that a housewife is a domestic engineer. It sounds impressive as hell as long as you don't inquire too deeply into the details. For the time being, I was simply hoping that Longchamps would seize on the idea that I was more than a truck driver. If possible, I wanted him to start thinking about the possibility of geese and golden eggs.

"And reincarnation. . . ." he suggested delicately.

"I don't want to get into a new body for, uh, religious reasons."

Longchamps went back to looking wise. I was willing to bet that he got a lot of mileage out of that look. It was much better than the befuddled look he'd been wearing when I came though the door. "You are aware that I am, as it were, a last resort. My patients are the ones who fall through the cracks of the mainstream medical techniques. As you have no doubt discovered, there are certain varieties of pain that are simply intractable with current medical technology. I offer another route entirely."

"That's kinda what I was hoping."

"If we were to make an analogy to a river, the conventional approach to pain management is to place a dam across the river—to attempt to stop the pain." He shrugged. "For some people, it works well. But for others, the pain builds up behind the dam and overflows the top. My approach is more subtle and elegant. I divert the river. I channel it elsewhere so that it can be made to do something useful."

I affected surprise. "Useful? Meaning I can charge batteries with it or something?"

He smiled in return. "Perhaps useful isn't the best term to use. Let's say that I take the river and channel it into a park with beautiful flowers on the banks and wide, grassy meadows on both sides where you can fly kites or have a picnic. A pleasant place. A wonderful place. I take hell on earth and turn it into heaven."

Whether Longchamps had a naturally mellifluous voice, or had simply worked up his patter as he grew more adept at seducing victims into his scheme, I didn't know, but without meaning to, I'd been sucked into the flow of his imagery. It took a second to regain my perspective. No wonder Dr. Straker had fallen prey. The fact that she'd been suffering genuine pain would have made it that much easier to talk her into it. I wasn't even hurting, and he'd already half-convinced me that it was the thing to do.

"Is it legal?" I asked.

"Well, let's put it this way. The medical profession has certain accepted ways of going about things. Over time, new methods are introduced and older, less effective ways are discarded. There's always a slow, steady turnover of methods going on. This is a relatively new technique—I flatter myself that I am active on the forefront of the pain problem—and will, no doubt, be in the mainstream in the near future. In the meantime, I think that you'll find that there aren't too many people who practice this technique. We're pioneers seeking alternatives."

Which didn't answer my question, but it was fun listening to him twist strings of words together into a fascinating yarn. As long as I remembered not to get lost in the flow, it was great entertainment.

Twenty minutes later, I was back on the street with an appointment for the following Tuesday for a more detailed examination to see if I was an appropriate candidate for his procedure. Or at least that's the way he phrased it. I suspected that anyone who had a heartbeat would be found an 'appropriate candidate.'

Cynical me.

On the way back to the office, I stopped by to see Bruce Masters. His secretary looked me over very carefully indeed before deigning to press the button on her desk. She was not at all pleased with me. I didn't have an appointment and that was endangering her entire orderly existence. "Mr. Masters, there's someone here to see you. A Mr. Jack Sawyer."

She was wearing one of those thin headsets with a miniature microphone on a slender boom, so I didn't hear his reply, but she nodded at whatever he'd said, then pressed the button to break the connection. Her attention transferred to me. "Mr. Masters says that if you'd like to wait for a few moments, he'll try to make room for you in his schedule."

I made as though to sit, then turned back. "Your hair looks nice that way," I told her.

She blinked. "Excuse me?" She tried to act frosty, but it didn't quite come off. Her hand began smoothing away imaginary imperfections in the waves of her hair.

I sat in one of the faux vinyl seats and picked up a magazine. I glanced up at the secretary in time to see her hurriedly look away. The distant, chilly professional persona she wore was only a front. I was willing to bet that she, like her boss, wore trendy fashions and went to all the mod bars.

Before I could plan my attack, she said, "Mr. Masters will see you now."

Bruce Masters's office was smaller than the state of Rhode Island, but not by much. I thought about asking the secretary for directions, but decided that it would ruin my self-reliant image. I surveyed the expanse critically, thinking that if SynthesEyes had this much money, I should have quoted a higher fee. Then I focused on Masters. "Nice place you've got here. Ever lose visitors between the door and your desk, or do you send out St. Bernards with tankards of brandy under their necks?"

He gave me a pained smile. "We've found that satellite guidance works for those who don't have a bump of direction. Now, what do you have for me?"

I gave him about half of what I'd found out, just to make him feel that he was getting something for his money, then asked the question that was my real reason for dropping by. "By the way, who's paying to keep Dr. Straker's body ready?"

He frowned, immediately alert. "That's confidential information."

I tried to look understanding. "I'm trying to get a feel for Dr. Straker's position as to why she's not moved into her new body."

Masters regarded me steadily for a few moments before replying. "We have a very generous insurance plan. The plan pays for a new body should one be required. The insurance company quit paying when Dr. Straker refused to schedule a date for the transferal. I'm not sure what other arrangements she's made."

"So she's paying the holding fees herself?"

He shrugged. "I wouldn't know. Perhaps you should find out. You're the detective."

On the way out, I leaned over and kissed his secretary gently on her cheek, then walked away.

Toujours de l'audace.

I was running low on people to annoy—not that there were that many to choose from—so I decided to start back in on Dr. Straker.

I gave her time to get home from work, then dropped by unannounced. I knocked lightly.

"Who is it?" came her muffled voice from the other side of the door.

"Sawyer. I've come to take you dancing."

"*What?*" But she opened the door, undoing the chain, then backing away from the door just like before.

I stepped in and closed the door behind me. "Okay, maybe it's a little early to invite you dancing, but I wanted to get my name on the list. Once you get into your new body, you'll have suitors lined up around the block and I won't stand a chance."

She looked at me for a minute, unsure as to whether to take me seriously. "You're a strange man," she said finally.

I shrugged. "Life frequently hands out rough deals. You can either laugh or cry about it. Laughter doesn't require as many tissues."

"That's easy for you to say," she said bitterly.

I perched on the end of her couch. "Why so blue? Sure, things went wrong a while back. But you've got a new body waiting for you. A few days in the hospital, and you'll be as good as new. Better, in fact."

"It's not that simple."

"Sure it is. I've done it."

She shook her head, looking into her lap. "You don't understand."

I slid down onto the couch seat so that I was sitting normally. "Tell me about it."

She shook her head again.

"Pretty please, with icing on top?"

She snorted, looking at me sideways. "I haven't heard that since I was a child."

"The old ways are the best ways. Talk to me. You'll find that I'm a good listener."

She took a deep, slow breath, then let it out in a slow, descending whistle. "I'm in trouble." Another breath. "But I'm going to handle it. My way."

"I did it . . . my way," I sang softly. "Okay, so you're in trouble, but you've got a plan. Tell me. Maybe I can suggest improvements. Fine tune things a bit. Try me. I've got a vivid imagination."

"I did a dumb thing. I went to a doctor who . . . well, he's not honest."

"Dr. Herbert Longchamps."

Her head jerked up. She stared at me. "How'd you—"

I smiled a wide, innocent smile and spread my hands. "Detective, remember?"

She sighed. Her head fell. She watched her hands fluttering in her lap as though they belonged to someone else. "He said he could take care of the pain. Well, he did. The price was high, though."

"And now you're addicted to pain."

She nodded, still gazing into her lap. "Have you ever had a mosquito bite or poison ivy . . . something that itched insanely? You know you shouldn't scratch it. It'll only make it worse . . . but it's maddening. So you try a little scratch. And the relief is something that there simply aren't words for in the English language. Soon you're raking your fingernails across the itch because it feels wonderful . . . incredible. Sometimes you even manage to get the itching to stop for a while. Then you find yourself wishing that it would start again, just so you could scratch again and get that terrible, guilty relief that only scratching can give you. It's a bad, bad feeling to realize that you're wishing for an unpleasant sensation." She looked up at me. "This pain thing is like that. I'm addicted. I know I'm addicted. I don't like it. But I've got this love-hate relationship with the pain. I know it's bad for me, but I absolutely crave it."

"There's got to be more to life than that."

"There used to be. Now there isn't. It's just me and my addiction. I'll live with it until I die from it."

"Die from it? That doesn't sound good."

She smiled without humor. "I did some reading. They wired lab animals—mice or rats, I forget which—so that every time they pressed a bar, they got a jolt directly to the pleasure center of their brains. The mice died. They pressed the bar until they starved. There was food available, but they ignored it. Just kept pressing that bar until they couldn't go any more."

"A grim story."

"I've reached the stage where it's difficult to eat. I have to force myself."

"You mentioned a plan."

She smiled sadly. "I remember the expression on Dr. Longchamps's face when he told me where I could go to get more of that lovely pain. I'd been leaving bruises, you see, and starting on things that drew blood. These folks are professionals. They never leave a mark. But, oh, the sensations they can give me . . . you can't imagine, Mr. Sawyer. You said you have a vivid imagination, but trust me, this is beyond anything you could ever find in either dreams or nightmares." She paused, remembering, then gave me a bleak smile. "But I know who did it to me, and I tell myself I will make him pay."

"How?"

"If I can just get over the hump . . . if I can just force myself to get into my new body, I'll tell the cops. Every day I wake up and tell myself that today's the day. But by nightfall, I'm a slave to my pain. The pain I carry with me always, and the pain they apply to the outside of my body. They won't let me have my pain if I don't do what they say. They ask questions now—they want to know about the things I do at work. I don't want to tell them, but I can't . . . I can't stop myself. They hold back on the pain if I won't tell them what they want to know."

I reached across and took her hand. "What's your name, your first name?"

"Vera. Why?"

"Because I'm tired of calling you Dr. Straker. Vera, will you try to let me help you?"

"You some kind of counselor? I thought you said you were a detective."

"Sometimes I have to be a little of both. Maybe if we can break the cycle you can get control of your life again."

"I'm afraid," she whispered.

"Afraid of what?"

"What if nothing ever feels as good again? Will I spend the rest of my life regretting getting into my new body?"

"Probably both yes and no. There aren't too many sensations that go directly to the pleasure centers of your brain, but it's not as though life without synesthesia means that you don't experience *any* pleasure. Setting aside Sonny Rollins playing saxophone and sunsets and the smell of a steak cooking on the grill, there's always holding someone in the small hours of the night."

"That was delicately phrased."

I gave her a suggestive look. "You catch my drift."

"Is sex better in a new body?" she asked.

I laughed quietly. "Vera, I don't know how it would compare with electric shock, say, or perhaps a gentle nip with a pair of rusty pliers, but it's pretty good."

"Rusty pliers, huh?" she said contemplatively, eyes closed. "God, I love it when you talk dirty." She opened her eyes again. "Maybe if I could get you to spank me. Just a little bit?"

I patted her knee. "Not in this body, dear. Maybe in your new one."

I got out before she suggested any more kinky delights. I'd spent half my day with people telling me that paradise was just over the horizon if I'd only readjust my limits as to what I regarded as normal. It was beginning to sound tempting. I needed to get back to reality.

There are dark places in everyone's soul where they prefer not to look. Without meaning to, Vera Straker had turned over a rock that I would have rather have left alone. There are normal amounts of pain that we all accept. If a mosquito lands on your arm, you slap it without thinking about it. Rarely do you hear someone complain when they slap their arm. Spanking is within some peoples' limits, particularly in private between consenting adults. Rusty pliers, though . . . that's getting to the point where few people would consider it fun. Viewed as a continuum, pain goes from unnoticed to things that would make even the Marquis De Sade blanch. How do you decide where to set the limit?

I'd always viewed pain as a price to be paid—or sometimes as a tool. If I managed to nail the mosquito, then the minor irritation was just part of the deal. But making the transition from pain to pleasure was a leap I had difficulty understanding. Pain is, or should be, unpleasant. It's nature's way of informing you that something's wrong. A negative feedback loop; something that's self-correcting. To flip the message on its head and say that something bad is good runs the risk of making it a positive feedback loop. An inherently unstable process that could easily oscillate out of control.

As it was doing in Dr. Vera Straker's life.

So how to break the loop? The more I sat and thought, the less I understood.

And the less Scotch left in the bottle.

The next morning, I tried to call Dr. Straker and got no answer.

She hadn't showed up for work, and she wasn't at her apartment, either. The woman I'd spoken with at work sounded as though she was worried. She'd said that it wasn't like Straker not to show up without at least calling.

By eleven I was worried, too. She should have been *somewhere* by now. I didn't care particularly whether it was work or home, but I wanted her to turn up long enough to tell me that she was safe.

By the end of the day, I was frantic—except that men don't use terms like 'frantic.' On the other hand, 'concerned' didn't seem to fully cover the bill.

Bruce Masters had called twice. He seemed to indicate—without ever coming out and saying so—that it was my fault that she'd disappeared.

I'd stayed around the office partly because it was the most likely place for Vera to come or call if she needed help. At five I dropped that excuse and started moving. I already knew that she wasn't at work, but home was another matter entirely.

The temperature had finally dropped the last degree or two and it was beginning to spit snow when I left. By the time I parked in front of Vera's apartment, it was dropping in big, heavy flakes that mushed as they hit my windshield. There was a hush to the world when I stepped out of my car, all sound absorbed by bits of velvet dropping from the sky. The snow was settling between the brown strands of grass left over from last summer's lawn. Patches of the lawn were already entirely white.

I knocked on her door, waited, tried the knob. It was locked. I slipped the latch with a piece of plastic I carry for contingencies. Not all doors can be handled that way, but this was one that could.

I slipped inside, not knowing what I'd find. It was warm, and a light was on down the short hall in what must be her bedroom. My gun slid into my hand almost of its own volition. I crept down the hall silently.

Nothing. Her bedroom was empty.

To be thorough, I checked every space big enough for a human to hide, but found no trace of Vera or anyone else. Then I went back through again, looking for anything that might give me a clue as to what had happened. An hour later, I'd searched under drawers, between mattresses, and behind the toilet tank. Nothing. I called my place and got my alter ego moving.

"See if you can trace any activity on her phone. Incoming or outgoing phone calls. Also, there may be something here in her computer terminal."

It took him about thirty seconds to crack the encryption on the password she'd used for her computer. Two minutes later his face popped up on her computer. He said, "She kept a diary."

"On her computer?"

"Yes. And there are some interesting entries in here. The most pertinent thing at the moment is that since you came into her life, she's been giving much more serious consideration to getting into her new body."

My eyebrow raised. "Check to see if—"

"I'm already on it," he said. "Give me a second."

It was considerably more than a second. Fully ten minutes passed while he infiltrated the computer at the reincarnation clinic. "She's there," he said. "In for transfer."

My brow furrowed. "Something's not right, here. Surely, she would have at least told the people she works with."

"I agree," he said. "Setting aside the question of her addiction, she seems to be a conscientious woman. Even in her current state, all her bills have been paid on time. This doesn't seem to fit the pattern."

"I'm going over there."

"The clinic's closed for the day," he pointed out. "Unless you plan to break in and save her from being reincarnated in her new body—the very thing you were urging her to do—it'll have to wait until tomorrow morning."

"I shouldn't have waited so long to get started."

His image nodded. "Yep. I'll help you kick yourself for that one."

Something was bothering me. "I'm assuming that there are forms requiring a signature, or at least there were when I got reincarnated. See whose signature is on the forms."

Twenty seconds later, he came back and said, "The signature is that of our old friend, Dr. Herbert Longchamps."

It might be too late to visit the clinic, but I was itching to drop in on Longchamps, and that was an itch I intended to scratch.

Turned out that he lived in a rather grubby area that the city was trying to 'reclaim' from the lowlife. Older houses were being gutted and turned into renovated wonders of modern technology that would—at least in theory—appreciate and become valuable property. For the time being, crime rates were still high and property values were low. The juxtaposition between law and lawlessness seemed appropriate for a man who straddled the line himself.

I rang the doorbell and waited, glad that they'd left the old porch roof intact. It kept the snow from going down the back of my neck.

The door opened and a woman stood looking at me like I was a stray cat with mange. "Yes?"

"I'd like to see Dr. Longchamps, please."

Her brow dropped a quarter-inch as she frowned. "This is highly irregular. My husband doesn't see patients at home and it's after office hours in any event. I'm afraid it'll have to wait until tomorrow."

"*Au contraire*," I said. "It won't wait until tomorrow." I forced my way past her into the warmly lit front hall. She flinched back from me as though I'd bite. After a frozen moment of indecision, she fled towards the back of the house calling for her husband.

Moments later, he appeared, looking just as befuddled as he had in his office. That look firmed, however, once he recognized me. "Ah, Mr. Franks. Surely you're not *this* impatient to begin? Our appointment wasn't until—"

"Actually, my name is Jack Sawyer and I wanted to ask a question."

"Jack Sawyer?" he spluttered. "That's not the name you gave me at the office!

And what's this about a question?"

"I want to know why you forced Dr. Vera Straker into the clinic."

I could see connections forming in his mind. Dr. Straker may have mentioned my name—or may not have. Either way, he was beginning to sense that things were not as he had assumed. His eyes flickered involuntarily towards his wife. "Uh, Mr. Franks . . . er, Sawyer, let's step into the living room, here." He turned to his wife. "Everything's quite all right, dear. Quite all right. Just give us a moment to talk and I'm sure everything will be all right."

She wasn't buying it. "So which is it, Herbert? Is it all right now, or will it be all right after you talk to this man?"

"I'm afraid I must insist, my dear. Please wait for me in the kitchen. I'll be along shortly. I'll explain then." Without waiting for her reply, he gestured for me into the smallish living room.

"Herbert, is something wrong?" she demanded, still standing in the hallway. His wife looked like the meek sort, but judging from the iron in her voice, there was more to her than her outward appearance would indicate.

Longchamps himself adopted a sharper tone and ordered her to go to the kitchen in no uncertain terms. She complied, but not without looking back over her shoulder. He then turned to me. "What, may I ask, is your connection with Dr. Straker?"

"That's not important at the moment."

"And what leads you to believe that I had anything to do with her entering the clinic? Surely you don't disapprove of her getting into her body at long last."

"Actually, the question is why she wasn't in it months ago."

"But what makes you think I had anything to do with—"

"There aren't many signatures that can initiate the process of transferal into a new body. One is the patient's, of course. Another is that of the patient's physician. It's your signature on the bottom of the form. So why didn't Dr. Straker sign the form herself?"

He shook his head. "Really, I don't see that it's any of your business. Confidential, you know."

"Meaning something that you'd rather I didn't know about. Like, for instance, your friends who've been supplying Dr. Straker with pain."

"Who the hell are you?"

"I'm a detective. I've been investigating your little scheme on Dr. Straker's behalf."

"She hired you? But—"

"No. Someone else hired me." I watched him chew on that for a second. "Now, I'd like to know what's going on with Dr. Straker. I know you've got her hooked on pain, and that you're using that as leverage to pry information out of her about the work she's doing at SynthesEyes. That information is probably paying for this house, but it isn't the legitimate practice of medicine, and you're in a lot of trouble."

I'd caught sight of his wife out in the hallway. She had a shotgun. Her intention was probably to keep me from harming her husband, but she'd heard at least part of what I'd said and it had stopped her in her tracks. She was standing just out of his sight around the door frame with the gun half-raised, mouth half-open.

It was slowly dawning on Longchamps that something was amiss. I was beginning to wonder just how good a doctor he was if he was this slow on the uptake. "A detective," he said. "Police?"

"No. Private."

He snorted. "I didn't know they made those any more."

"You got Dr. Vera Straker addicted to pain by transforming her into a synesthete. You've been using her addiction against her to get information about SynthesEyes's technology. Who'd you sell the designs to?"

He frowned, his fingers tapping a soft rhythm against the side of his leg. I could see him thinking it through; finally arriving at the conclusion that I wasn't going to stop asking questions and I wasn't going to simply vanish in a puff of smoke. He gave forth a very annoyed sigh. "Artificial Ocular. They've got a similar product, but they couldn't get the UV end of the spectrum to work."

"You took a big risk shopping Dr. Straker's information around. You didn't know the market. You might have contacted the wrong person."

Longchamps shook his head. "Not as much of a risk as you might think. I know someone who works at Artificial Ocular. Otherwise, the whole thing would never have occurred to me."

"It's a sad thing when a woman begins to salivate at the mere mention of rusty pliers. She imagines the pain they can bring. Pain which you wired directly into the pleasure centers of her brain."

Longchamps's eyes were remote, perhaps remembering the night before. "And that's what went wrong. Dr. Straker went for a . . . session last night. It seems that in her enthusiasm she lunged for the probe that's used to, ah, induce sensation. She was hurt very badly. We were able to keep her alive overnight and checked her into the clinic for transferal into her new body this morning. So you see, all will be well, after all."

"You kept her alive all night? Suffering? Why didn't you take her to the hospital, or take a personality backup and let her body die? Did you keep her alive so you could ask her more questions about her work?"

His right eye twitched. "Uh, well, we did ask her a question or two . . . but, Mr. Sawyer, she wasn't *suffering*, she was enjoying it. Don't forget, she was—"

"Yes, yes, I know. You wired her pain receptors into the pleasure centers of her brain. And you think that justifies what you did?"

"If someone is begging for more, it's difficult to see what harm's being done."

His wife was in the door, shotgun pointed at the floor. "Herbert . . . what are you saying? Are the things this man saying true?" She sounded dazed.

His head snapped around. "I told you to wait in the kitchen!"

She was not going to be deterred. "You did these things?" she demanded.

"I . . . I'm not proud of it, but yes, I did."

She looked as though the starch went out of her spine. Her shoulders slumped and the shotgun slid from under her arm. She paid no attention to the gouge the barrel made when it struck the wooden floor. Her face raised, eyes full of tears. "Herbert? What have you become?"

He went to her, raising his arms as though to hold her. Just before he reached her, he bent suddenly, going for the shotgun on the floor. I reached under my jacket for my gun, but his wife beat me to it. She simply stepped on the stock of the shotgun, effectively pinning it to the floor. He couldn't get his fingers under it.

I walked over and prodded him in the ear with the barrel of my pistol. "The game's over, Dr. Longchamps. Stand up, walk over and sit in the chair." I turned to his wife. "Ma'am, would you be so kind as to call the police?"

She nodded numbly and left.

I stood across the room with my gun aimed at his chest until the police arrived.

Then I went home and had a stiff drink to help my hands quit shaking. There was something evil in his rationalization of using pain to get what he was after, but what really churned my stomach was the blankness in his eyes—he couldn't see the harm in what he'd done.

Dr. Vera Straker's eyes opened. She blinked a few times, looking at the ceiling, then looked around the room. She squinted at me, trying to focus. It took a moment for her to recognize me.

I smiled encouragingly. "How are you feeling?"

"Like my skin doesn't fit right," she

said thickly. "And I can't see very well."

"It'll pass. It takes a little time for your brain to train your new body to do the things that you were used to doing in your old body. You'll be a little clumsy for the first week or two, but you can walk and eat and do most anything you want as long as you concentrate on each motion. It won't be second nature right off the bat."

She smacked her lips as though her mouth tasted bad, made a face, then said, "How long for the metallic taste to go away?"

I shrugged. "Brush your teeth and you'll be fine."

The next thing she did was slowly raise one arm. Then she raised her other hand, reached over and quite deliberately pinched her arm as hard as she could. She gave me the kind of a lopsided smile that people give you after a trip to the dentist; as though her mouth was partly numb. "Hurts."

I nodded. "Just like it's supposed to. A new beginning."

She sighed and turned her head to look out the window. "I don't know whether to be glad or sad about that."

"Both, I imagine. It'll take time for the dust to settle."

"What about Dr. Longchamps?" Her tongue had trouble forming his name. It came out sounding like Longshot.

"Arrested. You're not the only one he ever did this to. The police had a field day with his files. He and the guys you went to for pain are going to be looking out at the world from behind bars. There might also be a legal skirmish between SynthesEyes and Artificial Ocular."

She smiled. "Then it worked."

"What worked?"

"I managed to hurt myself badly enough that they'd have to reincarnate me."

"You did that on purpose?"

"Yes."

"You're brave."

She shook her head. "Not really. I'm a coward. I took a fresh personality read just before I left my apartment. If I'd overdone it, they could have used my backup to reincarnate me. I'd only have lost the one night. As it was, I managed to hang on until morning." Her face clouded, remembering. "What price ecstasy? I remember every moment. I don't know whether I'll ever feel pleasure that pure again."

"There's more than one kind of pleasure. Just wait until you try chocolate for the first time in a new body. You just *think* you've known pleasure."

Vera laughed. In the middle of the laugh, the right half of her smile suddenly snapped into place as her mind established contact with that part of her body, leaving her radiant. "Chocolate, huh? You're offering this to a woman with an empty stomach?"

"A far better deal than you would have gotten from Herbie Lambchops. He intended to rewire your new brain without bothering to ask your permission. He didn't want to lose you as a patient. Or as a source of information."

"All for the best, I'm sure, although I'll probably spend a large part of my life looking back over my shoulder, remembering what it felt like. I guess I have you to thank for that."

I tried to look modest. I failed. "Just doing my job, Vera."

"You promised to take me dancing."

"That I did."

"There's just one thing."

"What's that?"

"I don't dance."

"Want to know a secret?" I asked, grinning. "Me either." ■

CAGED

Kyle Kirkland

Illustration by Sherlock

Cages come in many shapes and sizes. . . .

Danton Grell discovered the bad news in a simple enough way. As he neared the bioforensics lab he heard the chattering voices, a steady roar coming from his younger colleagues. But the minute he entered the room everyone became silent.

He looked around. Jeff, usually one of loudest talkers, was quietly pipetting samples into petri dishes. Pam was diligently punching a code into the fluorescence analyzer, which, Danton noticed, happened to be empty. Craig was looking at his palm top, intently studying a screen that Danton observed was currently blank.

"Okay," said Danton. His gruff voice seemed to echo in the quiet room, caroming off the DNA analyzers lining one wall and the chromatography machines lining another. Even after seventy-four years, Danton's voice had lost little volume. "What is it that everyone else knows and that I *should* know but presently don't?"

Pam and Jeff looked up, gave Danton an innocent look.

Danton frowned. "Don't you dare play clueless with me!"

Pam's shoulders slumped. Everyone knew that Danton's experience and his expert if slightly impatient guidance had made and sometimes salvaged a number of budding careers—which didn't excuse his frequent lack of tact, but at least made it tolerable. "Better head on over to the office, Dan. Trouble. It's Delia." Pam lowered her voice. "Your granddaughter's been arrested. On a *felony*."

Danton nodded silently and left.

Walking into the office of Director Ellen Kenney, Danton acknowledged her warm smile with a slight bow and a rare and very brief softening of his dour expression. More than twenty years her senior, he'd been around for all of her time at the district's Bioforensics Bureau, including her meteoric rise to the top. Although he and Ellen rarely argued, he well knew that she was fond of saying that Danton was the only thing in the whole place she failed to adequately understand.

Ellen was watering her plants—two rows of begonias, philodendrons, and African violets scattered along the window. Three more pots hung down from the ceiling, with green vines slithering out of them like inquisitive snakes. Danton sat down and waited for her to finish; gardening was the one leisure that Ellen allowed herself, and Danton didn't want to interrupt. But Ellen finished up quickly, and then Danton bluntly asked her for a leave of absence and told her why he needed one.

"I have to admit I'm surprised," said Ellen cautiously, "that you first learned about this from your colleagues."

"If you knew my family you wouldn't be surprised."

Ellen seemed uncomfortable. Danton could see that she was struggling—no doubt a conflict between her inherent curiosity and the need to maintain a respect for the privacy of her employees. All in all, Danton's opinion was that she'd done a pretty good job of directing the bureau—not an easy thing to do these days, considering its tarnished reputation. It'd only been a few years since the scandal of genetic profiling; although the local police and the district's Bioforensics Bureau hadn't been involved, others had exploited DNA information not only to profile criminals but also to foolishly harass and discriminate against innocent people who just happened to have similar genes. It was a challenge to the very existence of the newly established bureau, and an opportunity for critics to demand that biological forensics be relegatated once again to a minor, underfunded branch of police departments. Ellen, along with the rest of the country's bioforensics directors, fought hard to maintain the bureau's independence, and Danton had a lot of respect for her. With considerable reluctance he decided to volunteer some more information.

"Delia may be my granddaughter, but we rarely speak to each other," said Danton. "Never speak, actually." He hesitated; the memory, though easily dredged up, was preferably kept buried. "The day she turned eighteen she left my daughter and her husband's home, and never looked back. Worked her way through college. In six years we've only had one note from her."

The note was not a pleasant one, either. Delia had tersely indicated that she never wanted anything to do with her family ever again. Danton's daughter and her husband had been distraught, nearly inconsolable—for a brief period of time. But after two counseling sessions—minus Delia, of course—and an expensive bill from a well-known psychiatrist specializing in family problems, they had accepted Delia's decision and returned, apparently untroubled, to their professional careers. Danton had been the only one who'd failed to take it in stride. He'd never gotten over it, had never been able to deal with it. Maybe, he thought, it's because I'm so old. Maybe I'm getting maudlin.

Ellen gave him a sympathetic look. "Parents and grandparents can't help it if their children don't always grow up to be responsible. You can try—"

"That's the point," said Danton sharply. "We didn't try." He sighed. "You don't understand. My family has always placed, to put it mildly, a great deal of significance on careers, on accomplishments. In raising Delia . . . mistakes were made."

"I see," said Ellen. "I'm sorry." She gazed at the paper-thin monitor perched above her desk; with a few gaze-activated commands she called up various files from the main system.

"I know this is a bad time to ask for a leave of absence," said Danton, "but it's important."

Ellen nodded. "Quite so. And I wish there was something I could do. But I'm afraid I can't give you a leave of absence. Your workload is too heavy at the moment." Her gaze returned to Danton. "And I have to admit that I'm adamantly opposed to your presence on this case, even unofficially. It's an obvious conflict of interest, and while I'm quite certain of your impartiality, we cannot afford even the appearance of questionable ethics."

"I understand. But I'm not going to be involved in the investigation." Danton didn't wince but felt like it. But it wasn't that big a lie, he thought; I won't be involved very much at all. *Probably*. "I just have to be there. Actually, Delia won't be involved in the investigation, either. I read the preliminary report. The charges against her are clear and she's obviously guilty. It's all recorded on DVD and the security guards she fought with aren't likely to forget her."

Ellen glanced at the screen again, after calling up the report. "Indeed," she said, raising her eyebrows.

Danton smiled thinly. "She's always been a big girl. Can handle herself pretty well."

"Evidently." Ellen paused. "But she *will* be involved in the investigation. The motive for her rage and anger is not at all clear, and . . . well, logically she *could* have been involved in the robbery. I'm sorry to say that, but you can't overlook anything in an investigation. I've heard you say so often enough."

"She had nothing to do with the robbery," said Danton harshly. "Any fool can see that."

According to the preliminary report, the robbery of the Houland Medical Database Company had occurred shortly after Delia's fight with the security guards. The fight took place when Delia, who was an employee of Houland, had entered the main hall of their building, located downtown; after the iris ID scan and voice-activated code, the door opened and she stepped into the analyzer chamber for the weapons check. But according to the guards, Delia soon became belligerent without provocation. While the guards were occupied with the struggle to subdue her, Houland's data manager was knocked unconscious in his office and thousands of terabytes of private data—including medical histories, genome sequences, and physiological profiles—of nearly a million people were stolen. Ironically, Houland's hugely expensive network security had proved to be irrelevant: the thieves, who must have slipped through the gate during the melee, hadn't cracked the software, which was purportedly hack-proof. Instead they had simply stolen the hardware, the optical storage devices that physically housed the data. Such data was worth a lot of money on the "Black Infomarket," whose denizens included unscrupulous insurers and corporate human resource departments, as well as blackmailers.

Although the reason for Delia's sudden violence wasn't obvious, Danton had a sinking feeling he knew what had happened. And it was totally unrelated to the robbery, which in his opinion was therefore nothing but an opportunistic crime, probably by thieves who were constantly on the lookout for good chances. All of Houland's security camera tapes and DVDs had been carefully examined, revealing only a few fleeting and unhelpful images of trespassers with shirts hitched up over their faces.

"I realize that this is a tough situation for you," said Ellen kindly. "But like it or not, the timing of Delia's outburst is suspicious."

"Which is exactly why it would have been very stupid if she'd been involved in the robbery. And Delia isn't stupid. Besides, she's been working as a software engineer at Houland for more than two years. No previous problems and a spotless record. She's been named employee of the month twice."

Ellen smiled. "Quite a lot of information for a person who never speaks with his granddaughter."

"She's broken all ties with me and the rest of her family," said Danton evenly, "but that doesn't mean I can't keep tabs on her. Just to see how she's doing."

There were a few moments of silence. Ellen seemed to be thinking but Danton recognized the look. She's already decided, he thought; she's just searching for a way to say no gently.

"Your request for a leave of absence is certainly a reasonable one," said Ellen finally, "and I absolutely hate turning you down. But turn you down I must. What's more, I am compelled to forbid you access to all the files and prevent you from any participation in the case whatsoever. I'm truly sorry, but the bureau cannot afford any more criticisms of its ethics, including potential conflicts of interest."

Danton nodded. "Your position is logical." He rose. "And now I hope *you* understand what *I* have to do. You'll have my letter of resignation by this afternoon." He smiled and turned to go. "My retirement is long overdue anyway."

"Stop!" cried Ellen.

Danton paused at the doorway.

"This is totally unfair," said Ellen. "I need you and your experience, especially now that we're fighting for our survival. Whether you like it or not, you're an essential element of this bureau. Surely you must realize this. Your retirement threat is therefore simply extortion. I must say that I had a higher opinion of you than that."

"Extortion? I don't see it that way. It's just that I've got to have some time off." Danton shrugged. "Have no choice."

"Get back in my office and close the door." Ellen's voice was quiet but firm. After Danton complied, she said, "This isn't making any sense. Your personal life is none of my business, but I can't understand what you're doing. If all you wanted was just to see your granddaughter and 'be there,' as you say, you wouldn't need to take a leave of absence or to get involved in the case. It wouldn't take that much of your time. You could do it in the evening and weekends."

"That's right. But I can't. Have to drop everything."

Ellen looked at Danton for a few moments. "There's something you're not telling me."

Danton nodded slowly but said nothing.

Ellen waited. "If I'm going to put my head on the chopping block," she said at last, "I'd at least like to know why."

"Yeah," said Danton, "I figured. Well, seems only fair." He cleared his throat, something his younger colleagues knew prefaced either a delicate piece of information or an unusually long explanation. "I told you that my family has always emphasized careers rather than relationships. That was *my* way of looking at things, anyway. Georgette—you met her once, didn't you?"

Ellen nodded. "At a Christmas party, some years ago."

"Well, fortunately, my wife didn't always share my views. Georgette did a good job of raising our daughter. Afraid I didn't participate often enough." Danton paused and shook his head. "Anyway, Georgette died when Delia was a year old. My daughter and her husband, and the rest of their relatives . . . they're like me. Career first, family second."

Danton glanced at Ellen. Suddenly it struck him that she was about fifty years old and looked it.

Ellen seemed to realize what he was thinking. "I've never married and I have no children. I made a choice and now, it seems, I have to live with it. I have my career, and that's all I've got. For me it's enough." She glanced at her plants. Danton briefly wondered if the plants, to her, were surrogate children. "But, anyway," continued Ellen, "I think I can sympathize with what you're going through, and I can imagine the way you felt about things back then."

"Imagining is one thing. Dealing with it is another. Delia wasn't a quiet child. Always in trouble. What's the old-fashioned word?"

"Tomboy?"

"That's it. Tomboy. Got into more mischief than most boys."

"That can be demanding on any parent."

"Yeah." Danton frowned, deepening the creases in his heavily weathered face. "Well, Delia's parents weren't up to the demands. Neither was I. They asked me what to do." Danton's normally strong voice grew weak. "And . . . I told them."

Danton faltered. Ellen waited patiently for him to continue.

"I always loved chemistry, you know," said Danton. "My specialty. Biochemistry."

Ellen nodded.

"So that's what we did. I had great faith in biochemistry, always had, even as a little kid. With the chemistry set Dad bought me. So, chemistry was our solution. We gave her Grammenthol. Took her to a psychiatrist who gladly gave us a prescription. It seemed to work so we kept using it. Kept getting prescriptions. Made her docile. Quiet. Obedient."

"A lot of parents use these medications," said Ellen. "There's nothing wrong with that."

"Yeah, but for us it was a long-term solution. That's not what those drugs are for."

"I see." Ellen pursed her lips. "Is it a side-effect that you're worried about? Because of the long-term use?"

"Perhaps," Danton said. "I'm not sure but I think it's likely. Actually, there are two effects stemming from the Grammenthol usage. One is the possible side effect—some sort of physiological change. The other effect is psychological and much more definite."

"Meaning, I take it, that Delia doesn't like what was done."

Danton nodded. "Delia became resentful. The obedient but drugged child grew into a woman who felt a lot of bitterness toward her parents. And me." Danton paused and took a deep breath. "Can't blame her a bit. There'd been nothing wrong with the girl. Nothing.

All she needed was love and attention."

"Now, Danton," said Ellen gently, "you don't really know that nothing—"

"*Nothing* was wrong with her!" said Danton savagely. "Nothing that love and attention wouldn't have fixed. But we couldn't be bothered. Had our careers to think of. Delia needed love and attention and what did we give her? A goddamn chemical." The old man's head bowed. "Stupidest thing I've ever done in my life. I've lived seventy-four years and made my share of dumb mistakes. But that one was the worst."

The first thing Danton did with his unaccustomed time off was check the police station. Naturally Delia wouldn't have left him word of her whereabouts—or anything else, for that matter—so Danton had to see for himself.

He discovered that she had been released on bail. He also found out that the felony charge against her had been reduced to a misdemeanor battery. Apparently she had found herself a decent lawyer, and the D.A. had decided, pending further investigation, that there was insufficient evidence to connect her with the robbery. And the security guards weren't seriously hurt: they had shrugged off their injuries. After all, there'd been three of them, all males, against one female. . . .

Danton chuckled.

To his surprise, Danton's queries also revealed that Delia had left the station in the company of a young man. Was he a boyfriend? Serious, perhaps? That would be news to Danton.

With a little bit of work—not entirely ethical—Danton dug up the man's name. Jay Thatchur. With a little more work he got an address. Danton planned on visiting Delia that afternoon, and if she weren't at home he'd snoop around Mr. Thatchur's residence.

A slight pang tore at Danton's conscience. He'd promised Ellen not to misuse his authority. More than that—he'd promised not to interfere in any way, but rather to be a "fly on the wall," as Ellen had said. And to return to work the very instant that he was finished "fly-walling."

It'd been only six hours since his leave began and Danton was already stretching one of his promises to the breaking point. And more trouble was on the way: he was determined to accompany Pam on her visit to Houland. She'd been assigned the case, and she had told him she'd be there at 2 o'clock.

He took the subway downtown and got off at the station stop that was the second closest to the Houland building. He glanced at his watch: 1:43. Plenty of time for a little tour.

The main entrance of Houland's building let out on a busy avenue, but there was also a much quieter side street only 100 feet away. The street was flanked by a large office building and a high-rise condo, which created lots of dark nooks and crannies in which opportunistic thieves could hide—yet still have a good view of the surrounding area, including the Houland building.

He met Pam at the entrance to Houland.

Pam looked worried. "Please, Dan," she said, "don't do anything to attract attention to yourself. Ellen told me—"

"Yeah, yeah, I know. Don't worry."

They went up to the entrance. Pam's expression showed her lack of conviction in Danton's assurances. She opened the glass door to the foyer and went up to a booth with a visitor's placard mounted on top. The main door was a massive block of wood and metal.

Danton studied the door. It was keyed to an iris scanner, with protruding chin holder to steady the subject's head. A microphone was embedded in a small aperture nearby, ready to receive the voice code; it was an added security measure to confirm the scanner's results, although probably unneeded. While early scanner models had simply taken a low-resolution picture of the eye, the newest models used controlled light sources and high resolution imaging to beat any possible deception. This, combined with people's remarkably unique iris patterns, ensured that the scans were accurate. Everything was mounted behind a plate made of hard plastic. All of it was standard equipment.

". . . here from the Bioforensics Bureau," Pam was saying into a microphone. "Pam Meraville." She glanced at Danton. "And an associate."

"One moment, please," said a voice issuing from the overhead speaker. Pam and Danton waited while Houland's security computer checked Pam's voice pattern with that in the bureau's database. Soon the door buzzed open.

Danton followed Pam inside. Immediately they encountered a guard kiosk and a glass-enclosed chamber, looking somewhat like an old telephone booth. One of the guards waved them through, so they stepped around the chamber.

Beyond was a fairly large room with a bank of elevators at one end. The building directory indicated that upstairs there were offices populated by a lot of people with letters like "M.D." and "Ph.D." after their names.

A harried-looking man briskly walked out of a nearby office. "Ms. Meraville? Hi, I'm Lyle Wyth, data manager here at Houland." He extended his hand, although the polite smile on his face quickly faded. "As you might guess, we're quite busy these days trying to recover from the disaster. Frankly, the police have already made a thorough investigation."

"Yes, I know," said Pam, shaking his hand. "I've read their report. But we're not part of the police department."

"I see," said Lyle. "Not that I'm unhappy about having you here, but, I mean, what else can you do?"

"You'd be surprised at what we can do," said Danton over his shoulder. Then he turned his gaze back to the glass-enclosed chamber.

"My associate," said Pam uneasily. "Danton Grell."

Lyle watched as Danton examined the chamber. "Interested in our weapon scanner?" asked Lyle. His tone was a mixture of amusement and irritation.

"Sort of." Danton tapped on the glass. "You use ultrasound as well as terahertz?"

One of the guards stepped forward. "Yes, sir. We try to cover all the bases. There's a metal detector, too."

"So you hit them with a whole bunch of stuff. Pressure waves, terahertz radiation, mag fields. Anything else?"

The guard shook his head.

"I've never seen anything like it," admitted Danton. "Can I see the specs?"

The guard glanced at Lyle.

"Go ahead," said the data manager, sounding tired. "Try to find the manual for Mr. Grell. Can't say I see the reason for it, but these guys are the experts." He turned to Pam. "I suppose you'd like to see the actual crime scene now?"

"Let's have a look," said Pam. "I trust the police have left it cordoned off. They told us they would."

"Yes," said Lyle. His upper lip curled slightly. "It's pristine. They won't let us touch practically anything around here."

Lyle led the way into his office. He opened it by placing his hand on a silvered plate attached to the lock, then punching a code into a keypad.

"This where you usually work?" asked Danton.

"No," said Lyle dryly. "I usually work in Miami Beach. I only come here for coffee and doughnuts." Lyle glanced downwards. "Sorry," he mumbled. "It's been a trying time. Yes, this is where I usually work."

A large portion of Lyle's expansive office was surrounded by bright yellow tape. Lyle pointed to several machines sitting in the center. "Those held the optical storage disks."

Carefully Pam stepped over the tape. Extracting some small items from her purse, she got down on her hands and knees and sprinkled some crystals and powder on the floor. She sprayed the area with a fine mist, then took out a magnifying glass.

"This has already been done," said Lyle, with a glint in his eye. "A British chap, and his doctor friend, came by earlier. Forgot the fellow's name. The doctor was called Watson, I believe."

"I'm looking for DNA," said Pam.

Lyle peered at her. "One of the thieves may have dropped a chromosome or two?"

"Possibly," said Danton, as he examined Lyle's desk. "People shed a great deal of tissue all the time. Your house is full of it. A lot of the dust in your home is dead skin that flakes off." Danton looked up. "We're hoping to find some skin cells or hair roots. Or saliva. We've caught many a crook who was foolish enough to spit on the floor near the crime scene."

Lyle raised his eyebrows. "Impressive."

"Yeah," said Danton. "It is." Danton shot him a glance. "But we're the experts." He wandered over to the door of Lyle's office and looked outside.

"I suppose you're going to ask me where I was during the theft," said Lyle. "That's easily—"

"Surprised you have your office so close to the entrance," interrupted Danton.

"What? Oh, yes. But that's not so surprising. It's dangerous, yes, but I'm afraid it couldn't be helped. This isn't Houland's primary storage location. It's a backup. Our main site is far away, out in the suburbs. Nobody outside of the company was supposed to know that we keep a copy of the database here, and this building really wasn't meant to be a secure site. I mean, it's downtown, after all. Not the best choice for a secure area."

"So why was it done?"

Lyle pointed upwards. "Biomedical researchers, upstairs. They use the database all the time. You know scientists. When the database was offsite, they had to deal with the rigors of network security and the excessively long download times. So management decided to use this site as a backup copy, and thus the researchers here could have easy access." Lyle frowned. "That generous convenience came back to bite us on the ass, I'd say."

Danton took a few steps over to Lyle. "You were saying where you were during the robbery."

"Yes, I was. I was here." Lyle pointed to the floor near the door. "When I heard the commotion outside I sat tight and listened, but when I heard Delia's voice and one of the guards yelled what was happening, I rushed outside. All I knew was that one of our employees was flipping out. I don't remember anything else. Apparently it was a short time later that I got whacked on the back of the head. I was unconscious for more than fifteen minutes, they tell me." Lyle leaned over and brushed the hair from the back of his head. "See? What a bump!"

Danton looked. Close to an incipient bald spot at the crown of Lyle's head, there was a nasty, raised welt.

"Hope you went to the hospital for that," said Danton.

Lyle straightened up. "Of course. I got an MRI and all that. No permanent damage, thank God."

"Good. What hospital?"

Lyle appeared surprised. "Is it significant? I mean, aren't they really all the same?"

Danton gave him a long look. "What hospital?"

"Rodgers Memorial."

Soon Pam finished with the search. Danton was unsurprised that she found nothing.

About 5:30 that afternoon Danton drove past Delia's apartment complex. Her car was in the parking lot. Danton pulled his little runabout into the lot and walked up the steps to apartment 208.

A young man answered the door. He was tall with short brown hair and an athletic build. A gold ring, in the shape of something Danton couldn't make out, hung down from one ear. "Yes?" said the man.

"I'm Danton Grell. Delia's granddad. I'd like to talk to her."

The man's eyes widened in obvious surprise. "Hold on a sec," he said, in a faintly British accent. He gently closed the door.

Danton waited impatiently for a moment. The door opened again and the man leaned out. "Sorry. She's not seeing any visitors."

"All I want is to talk to her. Try to help her in any way I can. Whatever she needs, I'll do my best to get it done. You tell her I'll wait out here till she comes out. However long that may be."

The man gazed at Danton.

"You tell her that," said Danton gruffly.

"I will indeed." The man paused. "And for what it's worth, I'm on your side. She needs family at a time like this. Let me try to negotiate. Hang on. It might take a while." The door closed softly again.

Danton waited, slightly comforted by the man's attitude. He guessed that this was Jay Thatchur. If so . . . he could think of worse choices Delia could make.

Although the charges against Delia had been reduced, they were still serious: she was facing a possible jail sentence, albeit unlikely. But she was also facing the certain loss of her job. Obviously Houland would fire her, if they hadn't already. And what would she do now? Who would hire her after this mess? Danton sadly bowed his head. So much of her life was yet to come, but now things looked completely hopeless.

This is *my* fault, thought Danton. It was my mistake that let this happen.

The door opened abruptly, startling Danton. The man motioned him in.

When Danton was inside, the man whispered, "I hope to God you don't cross me up." Then he led the way through the den and to a small bedroom. Delia was sitting in a chair.

Danton stared at her. The last time he'd seen her was when he secretly attended her college graduation ceremony a couple of years ago. She wore her blonde hair shorter, now. And she'd added a few pounds to her already sturdy frame. She looked a little bit mannish. But she'd always looked very masculine, and walked that way too, remembered Danton. Kids used to tease her about it, called her "cave-girl."

Delia looked up briefly. She wasn't smiling but there was no anger either. "Hello, granddad. I suppose you've already met my fiancée, Jay Thatchur?"

Danton nodded.

"I'll be in the kitchen if you need me, love," said Jay. He walked out.

Danton sat down on the bed. Delia's gaze rested on the floor, her expression completely neutral.

Here is my granddaughter, in her mid-twenties, thought Danton. And I don't know her. She's a perfect stranger, to both me and to her parents. I know more about my coworkers than I know about her. He glanced at the walls, at the decorations—there was a poster of some kind of musical band, with a female lead singer. He glanced at the pictures on her dresser—one was of Jay and Delia, dressed in winter coats and smiling and mugging at the camera; there was a snow-laden ski slope in the background. Christ! Why the hell didn't I take her to the movies, or to picnics, go fishing with her?

They sat in silence for a few moments.

"Delia," said Danton finally. "I'm sorry about all of this. Is there anything I can do?"

Delia shook her head. "It's not your fault, granddad."

"Yes, it is."

Delia glanced up, a fleeting smile on her lips. Then her gaze returned to the floor. "I've been sitting here thinking. I can't for the life of me understand what got into me that day. I just . . . I don't know. Sometimes it feels like I'm in a cage. That sounds strange, but it's the way I feel."

Danton nodded.

"A woman in a man's body. Or something like that. Maybe the other way around. I'm trapped by, I don't know, things I can't shake off. It's weird. It's like I'm caged and I have to get out, to burst free. I just don't know what it is. But on that morning . . . nothing happened to set me off. I just went berserk, I guess. I wish I understood."

"That's something I want to understand too. Care if I ask you a few questions?"

"Not at all." Another transient smile. "That's your job."

The words hit Danton like a fist. You're at work, doing your job—that was what she was implying. You're here because you love your job, not because of me. But Danton ignored the sharp jab. He'd prove her wrong. "How soon after you went into the weapons scanner did you lose control?"

Delia's brow furrowed in thought. "Only a few seconds."

"Think, now. Be sure. Only a few *seconds*?"

Delia nodded. "That's my memory, at least." She paused, apparently thinking back. "Yes, that's right. I had just stepped inside when I starting yelling at the guards. I told them I wanted out. I guess they figured something had gone wrong with the machine. When they released the catch, I . . . barreled out and starting hitting, scratching, biting. I was enraged, but I don't know why." She smiled grimly. "Now I know what a bull feels like when a matador waves a red cape."

Danton looked thoughtful.

Glancing up at her grandfather, Delia said: "I want you to know I had nothing to do with the robbery."

"I never for a moment thought that you did."

"It was an awful thing," said Delia. "Houland's in big trouble. Not to mention all of the poor people whose data have been compromised. *My* records were in that database too. But perhaps that's only fitting, since I was the one who caused the whole thing."

"Been eating well lately?" asked Danton.

"I—what?"

"I asked if you've been eating well lately."

Delia gave him a puzzled glance. Then she patted her stomach. "Yes, a bit better than I should be, I guess."

"Do you usually eat anything on the job, at Houland? Lunch? Breakfast? Snacks?"

"Lunch. I bring my own."

"Make it at home? Or buy it somewhere?"

Delia briefly giggled. "I make it at home. Do you want to know the recipe?"

"Do you bring your own drinks? What about coffee and water?"

"Water I take with me. Bottled spring water. Honestly, granddad—"

"Humor an old man. Coffee?"

"In the morning."

"Made at Houland? Brewed there, I mean. Or bought?"

Delia hesitated. "Usually there are a few pots brewing in the guard kiosk. We early birds get a cup or two."

"Do you drink any special brand? Or the same as everybody else?"

Delia gazed thoughtfully at her grandfather. "I think I see what you're after. I drink the same brand as everybody else. And I don't have a precise schedule, so no one knows exactly when I'm going to arrive at work. Not even me. So nobody would know when to slip something in the coffee. Besides, on that particular morning I didn't even have a chance to get anything to drink."

"It doesn't matter." Danton rose and patted her shoulder. "I don't want to overstay my welcome. I just wanted to drop by. See how you were."

"And ask me lots of questions."

"Yeah. You know how fond I am of asking questions." Danton smiled, and to his surprise Delia did too—a little. "Appreciate you seeing me, Delia. I'm sorry about everything. I. . . . We made a lot of mistakes—"

"Let's not get into that. Okay? Maybe some time, some place, we can discuss it. If you want. But not now."

Danton nodded. He was pretty sure that they *had* to talk about these things: to sit down and hash it out. It was the only way to let out the hurt—hers *and* his. But he wasn't going to force the issue. It would happen only when Delia was ready. But in the meantime. . . . "Can I see you again?"

"I guess," said Delia. "Does the local jail have visiting hours?" Another partial smile. "Just kidding."

"You're not going to jail." After gently squeezing her shoulder, Danton left.

There were numerous psychiatrists on staff at the Bioforensics Bureau, so Danton had plenty of expertise from which to draw. Although Danton knew a great deal about biochemistry, he wasn't too familiar with psychoactive compounds.

Danton had to fight a lingering resentment every time he talked to psychiatrists. If only they hadn't made it so easy to keep Delia on drugs. . . . But no, it wasn't their fault, he thought. The blame was his: it was his idea, and he had been persuasive.

And what about Danton's daughter? And her husband? Danton had mixed feelings, and Delia's rejection of the family had driven a wedge between him and his daughter and son-in-law that had remained in place all of this time. Nor had the latest crisis served to revive any bond between them; to Danton's knowledge the rest of the family had failed to even attempt contact with Delia, despite having been told what had happened. They appeared to be completely oblivious to it all. For all intents and purposes they acted as if Delia no longer existed.

Maybe in their minds, thought Danton, she didn't.

Danton forcefully turned his thoughts to the job at hand. What the psychiatrists had told him about Grammenthol made sense, but unfortunately Delia's lab tests hadn't confirmed his suspicion. There was, however, a modicum of good news from the lab. A rat—of the two-legged variety—had been caught red-handed.

He was walking towards the bioforensics lab, puzzling over some of the most recent data, when Pam called out to him.

Danton turned. Pam was looking worried. Her usual, mild unease and chronic nervous tension had been magnified ever since she'd been assigned Delia's case, and now she was actually trembling.

"The director wants to see us in her office," she said in a shaky voice. "Pronto."

Danton nodded. He'd been expecting this. "I apologize for getting you involved. Had no right to do that."

"Hey," said Pam. "It's my doing. If I can't fully investigate a case, might as well not do it at all."

Her voice, Danton noted, had little confidence, and he winced to think that she might have to suffer because of things he'd asked her to do. And things he'd done in her name.

They made their way to Ellen's office and the secretary promptly showed them in. Danton tried to read Ellen's expression but as usual it was a mask, void of much information.

"I got a call from a Mr. Lyle Wyth, the data manager at Houland." Ellen gestured them to be seated. "A rather indignant call, I might add. He's quite upset."

"I'll bet," said Danton.

"I put him off," said Ellen. "I told him to call me back. I wanted to find out first from you two what was going on." Ellen stared at Pam and Danton in turn. "Well?"

Danton cleared his throat. "He's probably mad that I queried Rodgers Memorial about his medical exam. Plus he had to make a return trip to the neurologist, and he may have found out who put the hospital up to it. Although I don't know how he could have found out."

"You don't know how," said Ellen, "because you asked the neurologist not to tell him, is that it?"

"I have friends at Rodgers."

A flicker of anger crossed Ellen's face. "I distinctly remember telling you not get involved in the investigation."

"It's my granddaughter," said Danton flatly.

Pam shifted in her chair. "I'm afraid I don't understand."

"There's probably a lot of things you don't understand," said Ellen. She gave Pam a scolding look. "All of this was done in your name. You're the official investigator for this case."

"And I approved of all of it," said Pam.

"Even if you didn't know what was going on?" asked Ellen.

"I knew. I knew, that is, in a general sense."

"So how did Wyth find out?" asked Danton.

Ellen shifted her gaze to Danton. "I'm a little surprised you haven't deduced it. Wyth duly went when he was called back to Rodgers for more tests, but it seems he was quite curious. For some reason—perhaps he was wondering who was going to pay the bill—he called his insurance company. They made inquiries and discovered that the bill had already been paid. By the Bioforensics Bureau."

"Naturally," said Danton. "We're always the one who pays when we have procedures done on suspects."

Ellen's brows hiked up. "Suspects? Would you mind—"

A tone chimed. The secretary appeared on a large monitor mounted on one wall of the office. "Ms. Kenney, vid on channel 4. A Mr. Lyle Wyth calling. Says it's urgent. He's quite insistent."

Ellen hesitated.

"Put him on," said Danton. Ellen looked at him. Danton smiled. "Go ahead. I'd like to talk to him. This could be fun."

Ellen gave the instructions to her secretary, and Lyle Wyth appeared on the screen. Ellen punched in a code so that the camera supplying her image to the other receiver was in wide-angle mode. Lyle would see all of them.

"Ms. Kenney," began Lyle, "since we last spoke—whoa!" Lyle surveyed the room. "So. The gang's all there, huh?"

"We're having a conference," said Ellen coolly, "but I thought I'd take your call anyway. If you prefer, I'll ask my associates to leave."

"I'd very much prefer."

"Before I go," said Danton, "I'd like to ask you a question."

"Oh, that's right, you're the question man."

"Just a quick one and I'm done. During the robbery, exactly what did you do after you were hit on the head?"

"I believe," said Lyle in a condescending tone, "I already told you. I was knocked unconscious."

"Yeah. That's what you told me. But you're lying."

Lyle's eyes narrowed. "Ms. Kenney, I've had about all I can stand from this senile old buffoon."

"Senile?" Danton shrugged. "Probably. But I can prove you weren't knocked unconscious." Lyle continued to stare. "You may have a lot of medical knowledge, Mr. Wyth, but you got a little careless. That's understandable: most people don't know much about concussions. They think it's like a bruise on the brain. That's not quite right. It's more like a little seizure—you get hit and suddenly all your brain cells start firing away, at the same time, sort of like a very brief epileptic fit. Well, seizures leave biochemical signatures, which we can see using the latest and most sensitive imaging devices. That's what they did at Rodgers. They told me that while a small part of your brain had suffered a mild shock, it's 100 percent certain that you didn't lose consciousness. Not for a single solitary moment."

Lyle's jaw muscles began working, his eyes became slits.

He's shrewd, thought Danton. He won't give up easily.

"Okay," said Lyle. He let out a deep breath. "All right. I admit it. I was scared. Look, you'd have been too. The guy held a gun to the back of my head. After he hit me, he held a gun to me. He told me he'd splatter my brains all over the floor if I moved. I was sure he meant it . . . I was paralyzed with fear."

"That's understandable," said Ellen. "But why didn't you tell about this in the first place?"

"I'll tell you why," said Danton. "By claiming that he'd been unconscious, he avoided embarrassing questions like this one. Why didn't you simply press the panic button to alert the police? You carry a wireless alarm on you at all times, don't you? That's what a Houland exec told me."

Lyle sighed. "I told you, I was scared. Too scared to think. He was going to kill me. But, afterwards, I was ashamed. I'm a *man* . . . I should have done something, I shouldn't have just cowered in a corner."

"I have to admit, Mr. Wyth," said Danton, "you think fast on your feet. Right off the bat you come up with a plausible excuse. Or if not plausible, at least not wholly unreasonable."

"And you. . . ." Lyle's face grew red. "Ms. Kenney, the reason I called back so soon is that I found out an unsettling bit of information. This man, Danton Grell, is Delia Stinole's grandfather. And yet he's involved in the case. *That*, you may rest assured, is a severe conflict of interest."

"I can appreciate your concern," said Ellen. "But Danton is not officially involved."

"He *is* involved, officially or not. That much is obvious. I have friends, Ms. Kenney." Lyle's voice rose. "And this is yet another example of harassment! Your bureau is full of Nazis, eugenicists, and *creeps*! You won't get away with this. I'm a citizen and this is a free country. An unethical *jerk* like Grell should be put away. If he meddles in my personal affairs one more time, I shall take it to the highest court. I'll get him fired, and you too!"

The screen went blank.

"Well, well," said Ellen. Her eyes briefly sparkled, and her lips showed that the struggle to suppress a smile was only partially successful. "As one of my med school professors used to say: when the patient screams, you struck a nerve."

"He's guilty as hell," said Danton. "I know he did it. I know what he did, too. I just don't know how. Sneaky bastard."

Ellen gave him a skeptical look.

"I'm right about this," said Danton confidently. "Somehow he slipped Delia a drug—a drug that took advantage of all those years we plied her with Grammenthol. You see, I talked to some psychiatrists who know a lot about psychoactive medicines. They told me of the latest research that's identified a mild long-term effect of such medication. It seems that the brain adapts—and if a medication is used long enough the brain adapts so thoroughly that it takes years, sometimes decades for it to get back to normal, if it ever does. After long-term usage of Grammenthol, the brain becomes very sensitive to drugs that mimic the actions of certain neurotransmitters—Grammenthol starved Delia's brain for these transmitters, so her neurons learned to make do with only a little. What Wyth did was give her a whole bunch of them, and the neurons became overloaded. Naturally it had the opposite effect of Grammenthol—that's why she became so violent. Delia's fight was a deliberate diversion. Evidently Wyth knew he couldn't get away with copying all the data so he had to steal the disks instead. He set all of this up."

"If that's the case," said Pam, "we

should find some traces of that drug in Delia's system." She reached for her cell phone. "I'll contact the lab—"

"Don't bother." Danton frowned. "I already had one of her samples tested. The result wasn't what I expected. Oh, the drug is there in her bloodstream, all right. But only a trace amount. So small you'd think it might even be a contaminant."

"That's not good news for your theory," Ellen said.

"True enough. But I still think my theory is right."

An awkward silence followed.

"Dan," said Pam, "how did Wyth know what drug to use? Do you think Delia told him about Grammenthol?"

"Doubt it. She doesn't like talking about it, obviously. But he didn't need for her to tell him. Her medical records were held by Houland."

Ellen shook her head. "But what's his motive? Money? I'm sorry, Dan, but that's hard to understand. He's the data manager for a major medical database company. He's bound to be making a very good salary."

"Beaucoup bucks," agreed Pam.

"Yeah. Hard for me to figure too. He's not in debt, either. I checked."

"If you want an honest opinion," said Ellen, "I think your theory leaves a lot to be desired."

Danton leaned forward. "I still think I'm right. I have a hunch. And I've done pretty damn well over the years by trusting my scientific instincts."

There was another awkward silence, laced with slight degree of tension. Then Pam said, "Isn't it possible that the intense radiation from the weapon scanner had some sort of effect?"

"That was my first notion," said Danton. "But it doesn't fit the facts. I looked at the specs—the machine doesn't throw out anything that strongly affects the brain, and it would have been very difficult to reconfigure it to do so. Which isn't the only problem with that idea. Delia told me she was in the chamber for only a few seconds before she lost control. One of the guards confirms it, too. He said that he'd barely switched the scanner on before she starting yelling."

"I thought your *first* notion," said Ellen sharply, "was that Delia lost control because of some sort of long-term side-effect of Grammenthol."

"It *was* because of the Grammenthol effect. What I didn't realize in the beginning was that it had some help—in the form of a rat by the name of Lyle Wyth." Danton smiled thinly. "That's why you do a thorough investigation. You can't overlook anything."

Ellen clearly began to lose her patience. "But your drug theory has to be wrong because it's wasn't in her blood stream shortly after the attack."

Danton gave her an angry stare. "It didn't have to be in her blood. It just had to be in her brain."

"So how did it get there?"

Danton shook his head. "That I can't figure. Yet." He stood up. "And I won't find out by sitting around all day."

"I'd like you to reconsider your current strategy," said Ellen quickly, before Danton could escape. "As your employer—and, I hope, as a friend, I'm asking you to proceed carefully. I've given you a lot of slack, Danton." She paused, as if she felt Danton needed to give that little reminder a good deal of reflection. "Enough slack to hang yourself and, quite possibly, do serious damage to the bureau. Or at the very least, to one middle-aged careerist who happens to run it."

"Wyth's guilty," spat Danton. "And I'm going to nail him."

"Isn't it enough that Delia's charges have been reduced? And that she's not seriously being investigated for any role in the robbery?"

Danton stepped over to Ellen's desk. Putting two gnarled hands on the edge, he leaned over and faced her squarely. "You're not listening. Wyth's a crook. He belongs behind bars. For what he did to

Delia, I'd love to flatten the bastard."

"On the contrary, I've been listening to you quite carefully," said Ellen. Her tone was angry, caustic. "You've failed to provide any convincing evidence whatsoever for your claim."

"I, for one, don't need to be convinced," said Pam. "I think Wyth is a very suspicious character, and I don't buy for a moment his little act of being afraid—and then being ashamed to admit it." She turned to Danton. "But what we lack is a plausible way for him to get the drug into Delia at the right moment, and then somehow remove it from her bloodstream almost an instant later." She shrugged her shoulders. "Well, Mr. Biochemist? Any ideas?"

Danton looked helpless. "Not a clue," he said.

"Perhaps you should consider another possibility." Ellen's normally full lips were tightly drawn, thin and pale. "Perhaps you're simply looking for a scapegoat."

The turmoil inside Danton grew fiercely. He was furious at Ellen—but the anger mixed with guilt, and then turned inward. Maybe, he thought, that's exactly what I'm doing: trying to find a scapegoat for ruining Delia's life, so that I won't have to see the guilty party every time I look in the mirror.

Suddenly Ellen stood up. Her expression softened abruptly. "I must apologize." She glanced at Danton, then stared at her desktop. "I don't say things like that. I won't tolerate it. I must be more upset than I realized." She spun around and grabbed a waterspout off the windowsill; with jerky movements she began watering her plants.

Pam gave Danton a let's-leave-now look.

But Danton didn't turn to go. He stood watching Ellen—he stared at the green plants, at the sunlight streaming in through the window.

"Now I see," he said quietly. He smiled, a big smile that rippled his cheeks and threatened to split his face in two. "That little bastard. I knew he was a crafty fellow."

Ellen turned. Pam stared at him too.

"I know how Wyth did it," said Danton. He took in the questioning looks. "Think about plants," he said slyly. "Think about plants. What they do, and how they do it."

Danton had just pulled his runabout into the Houland parking lot when Delia arrived. Jay was with her.

Getting out of his car, Danton saw that Pam and Ellen were already there. Pam was getting the equipment set up.

Hope Delia's right about still being on Houland's list of employees, thought Danton. She'd received notice that she was "on leave pending further investigation," but that she officially remained on the job. That meant that she would still be in Houland's security system.

Delia gave Danton an inscrutable look. "Mind telling me what was so urgent about all of this?"

Danton hadn't told her much over the vid. He had, however, pleaded with her to come. It was life or death, he'd said.

"I'll explain everything later." Danton gently patted her on the back. "Thanks for having enough faith in me to come."

Pam finished clamping an electromagnetic radiation analyzer to the iris scanner. "Do you think we should let Wyth know what we're doing?"

"I've informed Houland's chief executive officer," said Ellen. "That's good enough."

"Ready?" asked Danton. Pam nodded. "Okay, Delia. I want you to go over to the iris scanner. Do just like you would to get into the building. Ignore the analyzer."

Delia looked at Jay and shrugged, then placed her chin against the holder. The scanner began to whir.

Suddenly the door opened. Startled, Delia jumped back.

A guard leaned out of the doorway. "Hello," he said, with a touch of menace. "Something going on out here that we should know about?"

Ellen flashed her credentials. "We're conducting an investigation. I've told your boss."

A loud noise came from within the building and the guard whirled around. Lyle Wyth came storming out. "Yes, yes," he was saying to another guard, "I've just been told by the CEO. I don't know what this is all about,"—he glared furiously at Danton and Ellen—"but you can bet your bottom dollar that someone's going to pay."

"On that, we agree," said Danton. He motioned for Delia to continue.

Lyle pointed to the analyzer. "What the hell's that?"

"You'll see." Danton waved to Delia again.

Resting her chin on the holder, Delia held herself motionless. A moment later, when a small green LED lit up, she spoke her name into the grilled aperture. About twenty seconds later the door clicked and opened.

Danton's heart raced. He stared at Delia. She shouldn't have a response this time, he thought; most of the drug is out of her system by now. But he kept an eye on her just to make sure.

Pam slowly detached the analyzer. Nervously she pressed some buttons and then slid back a cover, revealing a small liquid crystal display. Cupping her hands to screen out the daylight, she held the analyzer up to her eyes and examined the display. Then she handed it to Danton.

With a hammering pulse and sweaty palms, Danton took the analyzer. It's got to be there, he thought. He looked at the display; it showed a spectrum analysis of the radiation coming from the scanner. There was an energy peak at the expected frequencies—visible light—but this energy was dwarfed by a towering peak where there should have been only roughly equal amounts of energy. It was in the "near infrared" range of the spectrum, around 375 trillion hertz. Iris scanners use both visible and infrared radiation, but not *that* much infrared.

Danton handed the analyzer to Ellen. Pam smiled at him. He smiled back and turned to Lyle. "Gotcha."

Houland's data manager took a step back. Droplets of sweat glistened on his forehead.

"I'm awfully glad," said Danton, "that the police made sure you didn't touch anything. You tweaked the scanner to release a hell of a lot more infrared than it was designed to, but you never got the opportunity to undo it."

Lyle scowled but said nothing.

"For a long time I wondered how you managed to get the drug into Delia at just the right moment," said Danton. "Then I realized that you'd been giving her the drug all along. For days, weeks maybe. In the coffee. Everybody else got it, too, of course. But that didn't matter. Although they wouldn't have been as sensitive to the drug as Delia, it would have done something to them too—but it didn't. It wasn't activated."

"I'm going to call my lawyer," announced Lyle. But he stood rooted to the ground, staring at Danton.

"You'll need one." Danton turned to Ellen. "Your plants inspired me. They have lots of chlorophyll—a molecule that is *changed when it absorbs light*. Quite a few molecules do that, and chemistry labs take advantage of this all the time. They often use photosensitive molecules in combination with those that aren't. You take a substance and chemically combine it with photosensitive molecules. That way you make a new compound that still contains the substance, but it isn't active because it's got a bunch of other molecules sticking on to it. But if you engineer it right, when you shine a light on the compound it breaks the bonds of the photosensitive molecules and they fall off. Presto, you've got the original, active substance again. It's used in various manufacturing processes, as well as in a lot of research labs." Danton glanced at

Delia. "It's called 'caging' a substance. It only breaks out of its cage when light hits it. That's the way Wyth activated the drug at the right moment. It only took a little while to have an effect—just long enough for Delia to make it inside. Perfect timing. And that's why it was undetectable in Delia's blood stream, even right after the event: only the caged form was circulating in her blood. The beam activated only those molecules which managed to get past the blood-brain barrier and were in her brain."

"That's why he used near infrared," said Pam. "Unlike visible light, it can penetrate deeply into tissue, including the skull. The iris scanner conveniently held the head in place. All he had to do was configure it so that Delia was the only one who got the extra infrared dose—which he did by keying it to the voice activator."

Ellen stepped forward. "I've called the police, Mr. Wyth. They should be here shortly. I would advise you to start getting in touch with your lawyer now."

"Thanks for the advice," snarled Lyle. He glared at Danton. "You're so smart, aren't you? Think you know everything. But I know something about your precious granddaughter that I bet you don't. I looked at her genome." The mask of civility had vanished; Lyle's face turned fiendish as he grinned. "She's got the genes for lesbianism. She certainly looks like one, doesn't she? Her boyfriend's just for show. She's a goddamn dyke, Grell. How about that?"

Danton shrugged. "Makes no difference to me. I'm just glad she isn't a snake like *you*."

Flecks of foam appeared around Lyle's lips. His face turned a vivid shade of purple. He stomped back inside.

"Lord," said Jay, putting his arm around Delia. "I'd say that chap has some problems."

"Funny," said Ellen. "He spoke just now like some sort of eugenicist. But that's exactly what he'd indignantly accused *us* of being."

"He *is* one, I think." Danton frowned. "He accused us only because he knew it was a trump card: most other people, except himself, find it distasteful. Besides, it's not too surprising that he accused us of being something that he himself happens to be. Psychoanalysts call it 'projection.' Looks like Wyth is a firm believer in genetic determinism and in classifying people according to their genes. That's why he wanted to get the database into the hands of people who would unfortunately be all too willing to act on that fallacy. But the network security must have prevented him from copying the huge amount of data—so he concocted a plan to steal the storage disks. And for that, he needed a diversion: Delia."

Danton stepped over to his granddaughter. "Looks like that's about it," he said quietly. "Expect you'll get your job back."

"You're tops in my book," said Jay, smiling.

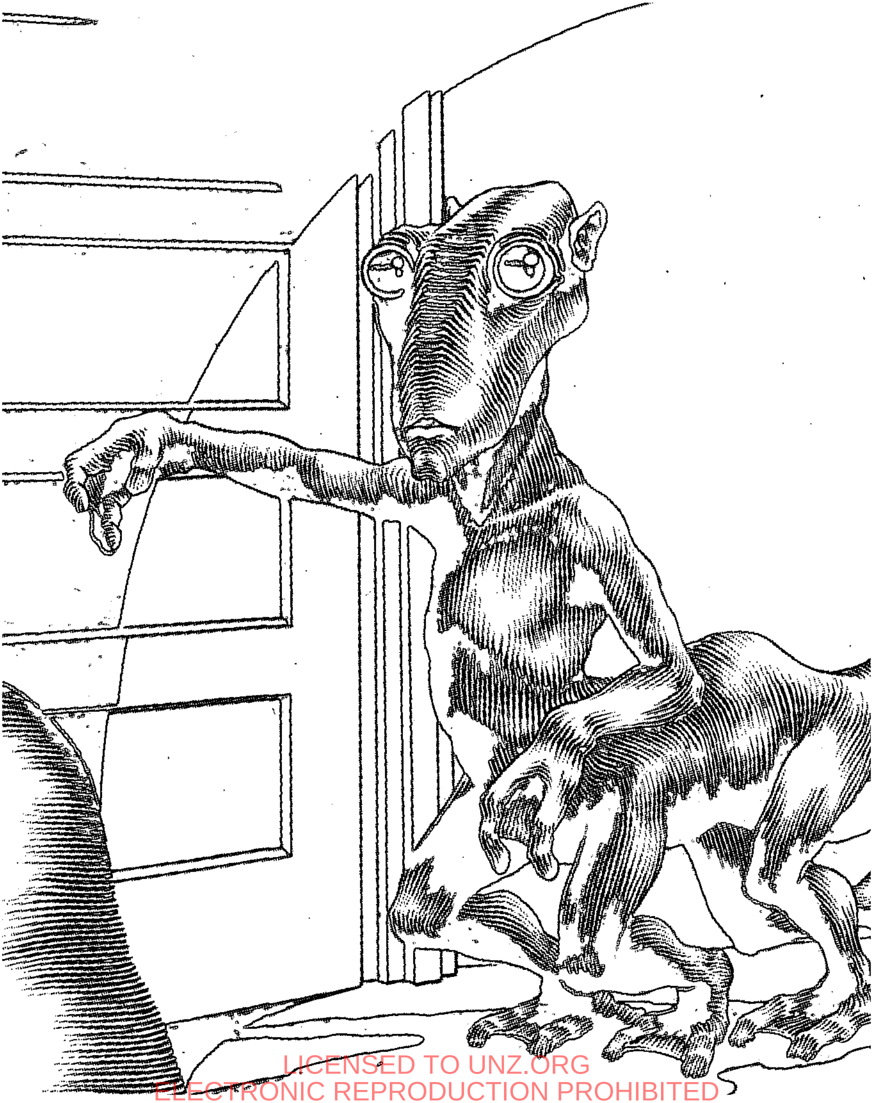
"Mine too," said Delia. She hugged Danton. "Now I understand why you devote so much time to your job. You're good at it. You're so good at it that it would be wrong for you not to do it. You make all of our lives better by saving us from people like Wyth. Now I realize how selfish I was for wanting so much of your time."

"You weren't selfish," said Danton. "Being good at your job is no excuse for ignoring your family." He glanced at Ellen, who was out of earshot. "I promised not to get involved in the case, but that's one promise I'm glad I broke. I also promised my boss I'd go straight back to work after this was over. But that's another promise I'm not going to keep." He looked at both Jay and Delia. "How would you two like to go fishing?" ■

Swings

Marie Ming

Illustration by John Allemand



ade it, the yellow roses were painted by Raya. Haydon ran his finger along e place where, a moment before, he d slipped two of the pieces of wood gether. Now, the workmanship of the ood and a few misleading brush rokes hid all signs of a seam. "There's ore of a puzzle here than that damn x," Haydon muttered to himself.

He returned to his computer and essed to organize Raya's medical data der neutral and innocuous titles such "Genetics of the mid- and lower- ain." Mac slammed into the dorm om before Haydon was finished.

"Mac, quit slapping your wet tail into erything. I have critical work open re." Haydon tried to keep his body be- een his screen and his brother. He re- zed he could have saved his energy. c was not one bit interested.

"I haven't had a break all day," Hay- n said the second he finished and ned off the machine. "How about a im?"

"Can't you see I goed already?" Mac inted. His six webbed paws left pud- s on the floor. His usually immaculate ck fur hung in dripping tangles.

Haydon prepared to snap a sarcastic swer at the little alien until he realized w miserable Mac looked. His little other's wet, snarled fur contrasted th his normally shiny coat. "Since en," Haydon said with concern, ve you ever turned down a second or n a third swim?"

Mac may be an engineering genius and a senior in college, Haydon thought as he grabbed a towel and began to scrub off some of the cold seawater, *but he's just a child, maybe nine-years-old. He's relied on Raya to fill the role of surrogate mother these college years. He's acquired tons of friends, but he still needs the bouncy girl who first carried him from the ship four years ago.*

Haydon rubbed Mac's tiny ears with the towel. Then he ran his hand down the old healed break in Mac's leg. The scar stood out against the skinny shin.

If Raya really is suffering from manic-depression, he thought, that disorder has a genetic base. I have her genetic code. I'll find which of her genes scrambled. As he gave Mac a few last pats, he realized his hands still shook from his criminal incursion into the college records.

Holding Mac, he flung the wet towel across the bedroom and onto the bathroom floor. With Mac dangling from his arms he headed out of the door, through the lobby, and toward the water slide.

"Where we go?" Mac asked. On the way down the steps, Mac wiggled into a position that was basically upside down. Haydon let him squirm, but he did not let go.

"Swimming," Haydon said.

"But you no change clothes?" Mac said.

Haydon pretended to be shocked. He

studied his shorts and shirt with exaggerated seriousness. "Do you know what?" he said, and flung Mac over his shoulder. "I'm already soaked."

"Water is so sad," Mac said.

"Water is never sad," Haydon answered, shocked by his little brother's comment. Mac adored water.

At the edge of the dormitory gardens Haydon put Mac down on the edge of a decorative pond. The water from the pond disappeared down a chute. That slide often carried them, in twists and turns, through giant jungle leaves and fragrant blossoms, to the ocean 800 feet below. The ride always made Haydon feel better. He could not stay in a funk with his body twisting and sliding at fifty miles per hour and his heart racing at 140.

Mac sat in a limp heap beside the pond where Haydon had dumped him. His tail moved only because it hung in the current.

"Look," Haydon said. "Your tail is in the water and it's already wagging."

Mac gave Haydon one of those looks limited to brothers. Haydon read a mixed message of "how dare you patronize me," on top of "you win again," on top of "someday I'll get you for this." But a tiny gleam in the pale blue eyes showed Mac's intentions to make the most of the moment. The natural swimmer turned his body into the flow of water and pushed off. Haydon leaped into the channel behind him.

For a month their routine remained the same. After each evening swim, and followed by watching Mac pretend to eat dinner, Haydon buried himself in the study of Raya's genes and manic-depression. His course work suffered and his test scores went down, but he completed the analysis of the first twenty-one chromosome pairs.

Mac was even less successful at his engineering projects. He designed bridges and anti-grav buildings on his Tri-D computer. When he got the structures half-built, he blew them up with nerve-shattering sound effects. Then he'd curl up in a sad ball of fur on his sleeping pallet and stare into space. If anything, Haydon's attempts to get Mac and Raya to talk to each other only made things worse.

A month to go, Haydon thought. He had given up all hope of winning the only scholarship to xenomedical school on Emergency Space Station 10. Raya's mental illness and Mac's reactive depression filled every waking moment.

During that day, the computer had found eleven genetic anomalies on chromosome pair #22. The first ten variations turned out to be very ordinary and non-pathological alleles.

He felt so frustrated he almost skipped the last genetic variation on chromosome #22. When he ran an analysis on it, he barely glanced at the results. Then he looked again.

"Brain stem cell growth," the computer screen said.

Haydon closed his eyes and took a deep breath. Then he ran the analysis again and demanded all possible data. "This gene directs the development of the cell walls of a set of cells in the brain stem," the computer answered.

"Which cells?" Haydon asked. "Are these cells involved in mood or arousal state? Be more specific."

"Unknown," the computer answered.

"What behaviors do these cells direct? Do they control any aspect of emotions or alert functions?" Haydon asked.

"Unknown," the computer answered.

Even the answer, the orphan word "unknown," was a significant clue. The disease had been genetically engineered out centuries ago. In addition, all newly conceived blastocysts were scanned. All severe anomalies were removed from the developing cells. The records showed no cases of manic-depression in hundreds of years. No wonder the computer could not answer. It had no case records of this allele.

He was almost sure he had found

Raya's genetic problem. But there were two more pair of chromosomes yet to be checked.

Haydon chanted a mantra under his breath of, "Take your time. Don't rush the analysis now." He directed the computer to check for variations on chromosome pairs 23 and 24. The one unexplained allele he had found on 22 might not be the source of the problem. He had to be sure.

The other chromosomes contained no variations worth a second glance. Raya had one pathological gene. It sat on both chromosomes 22 and controlled the development of cell walls for some cells in the brain stem. That correlated well with several references he found that explained theories of manic-depression. A gene on chromosome 22 was vaguely mentioned in the historical texts. The resultant brain malformation tended to be in the brain stem.

With that tantalizing data, he ran into a stone wall. No source could explain why or how that gene could cause a mental disorder. After three days of struggle to figure out the cause by himself, Haydon decided he needed a sounding board. Posha was his best friend. She definitely knew how to keep a secret.

Now that they were together, he hesitated. They sat on the wall of the holding pond, but far from the water slide. The sound of the falls formed a soothing background.

"Are you going to tell me what's bothering you, Haydon, or do I need to apply torture? A feather in the ear is usually sufficient." Posha stretched out her natural feathered cape and began her gentle attack. Her glider wings gave hints of ancestors who lived on the steep cliffs of her home Planet Basivo. Haydon was almost too distracted by his problem to notice Posha's cape-like wings.

Posha scooted around until she was sitting behind Haydon. She wrapped her "wings" around him as if to comfort him, then she clamped her four bat-like claws into his scalp. "All right," she said, allowing the needle claw of her right index finger to penetrate his scalp, "spill the beans. You've already started the analysis of Raya's genetic code, haven't you? You're stuck and need to talk about it."

"How could you possibly have figured that out?" Haydon said and tried to move. "You don't know a thing about genetics."

"But I know you really well, don't I?" she answered. "I bet little Mister Macarduboth is in a snit because he thinks you're not doing anything to fix Raya."

Haydon tried to move, to look Posha in the eyes, but she kept her hold. "I can't tell him I'm working on the problem. What I'm doing is too damn dangerous. And I shouldn't be talking to you either. We'll both end up in trouble with the law if I'm caught." He tried again to pull away. The penetration of Posha's other two claws forced him to settle back down.

"I've already earned my pilot's license," she hummed. "If they throw me out of college, I won't be upset for more than a week. College has been a wonderful experience. I'll use most of my acquired knowledge of trivia while flying weird aliens like you around the galaxy. But the degree is not worth much to me. So, start talking. I expect the details from you now."

"Please," he said. "If you don't care for your own sake, take pity on me. What I've done is so illegal that even a hint will get me thrown out of college. Worse, it will keep me from getting within three light-years of *any* medical school."

"But what you want is *xeno*medical school," Posha sang as much as spoke. "And no one is better qualified."

"Raya is," Haydon said. "Raya has the better grade point average, by far."

"She also has the mental illness," Posha answered. "And, many of her best grades are from art classes. All your electives are in sciences."

"Her science and pre-med grades are good too," Haydon said, started to turn to look at Posha, then felt four sharp reminders not to move.

"But not as good as yours," Posha said. "She does not have one elective unit in biology, neurology, chemistry, or any other topic related to medicine. Every non-mandated unit she has is in painting. You have the placement into xenomedical school wrapped up. Don't you understand that by now?"

"No," Haydon said. "I've watched her in class. She's brilliant. She's earned the xenomedical school scholarship."

"She's not even interested in it," Posha said. Her song took on the quality of a funeral dirge. "I bet she would turn it down if they offered it to her. Her parents pushed her into pre-med. She's smart enough to get the grades. It makes them happy. She, on the other hand, is so unhappy that she's refused to apply to any graduate school. If she entered medical school, she wouldn't finish. If she could stand to talk with anyone right now, she would tell you that herself. The xenomedical school position is yours. I swear."

"Okay. Maybe. Unless I get caught researching Raya's DNA," Haydon groaned. "If she weren't suffering from manic-depression, she would apply for graduate school."

"Yes," Posha said, "in some wonderful and exclusive art department. Did you hear me? She wants to continue in art."

The white bird-like being let go and came around to face Haydon. She raised her red head crest to full fury. "Now that you know Raya is no rival to your dreams, are you going to quit researching and mucking about in her DNA? Will you give up and do something nice and safe for your senior project?"

"No," Haydon answered. "Mac needs her."

"Ah, a bit of truth begins to shine through. Now we have the core of the situation. You've risked your career for Mac, because he's too cute for words, because he's God's hottest gift to engineering since the discovery of fire, because you both lost your parents and depend on each other, and because you two have been through hell together. He needs his little surrogate mother, Raya, and you are going to help him get her back, whole and healthy. Do I have it right?"

Haydon muttered agreement.

Posha let her crest drop down an inch or two. "Now that you've admitted the worst, why don't you tell me about your research? I won't understand a quarter of it, but I listen well. Perhaps if you talk at me and listen to yourself, the answer will emerge from the muck."

Haydon returned to his dorm with a few new research ideas and with the memory of Posha's soft feathers against his cheek. He leaned out the window until the sound of her shuttle engine blended and disappeared in the breeze. The last thing she suggested was, "Tell Mac and Dr. Kuper." That he could not do, but he could ask Dr. Kuper for some higher computer access.

When he closed the window, he found Mac waiting for their evening swim.

"Mac," he said, "I'm so sorry. I can't today. I stayed up all night doing homework for my senior project and haven't studied a thing for neuropathology class. I have a test tomorrow. Then, tomorrow afternoon, I'll meet with my advisor about my senior project.

"I do not mind," Mac said, "that we cannot swim every night. I do mind that you do not work on fixing Raya. You do a senior project on cell walls. That is dumb. Anyone can study cell walls."

For a moment, Haydon felt panic. How did Mac know about his research on cell walls? Then he realized that concept was a perfect cover for the real project. "Mac, I'm so sorry," he said. "I don't know how to help Raya."

"Not interested in sorry," Mac interrupted. "Not interested in your claim of ignorance. If you tried, you could help. You not try." Mac threw himself onto his mat and curled into a tense wad.

Haydon lowered his head to his desk and grabbed his head in frustration. After a very few minutes, he sat up and turned his computer on. It took several moments before he could see through the haze of frustration to the simulation in front of him. The picture was of brain cells. He had tracked Raya's pathological DNA to RNA to the manufacturing of amino acids and then proteins. The chemical trail led him to the construction of the cell walls of the locus ceruleus of the brain stem.

Something was wrong with the cell walls of Raya's brain part for activation and repose. One of the master switches to move back and forth between the sympathetic and parasympathetic nervous systems was defective. But what? Her computer-generated cell walls looked exactly the same as the normal ones in the data bank.

He pounded his fist onto the computer control panel. The computer, with multiple protections developed through generations of abuse from frustrated students, did not even blink.

Haydon gave up and tried to study for his exam.

After class, he sat across from Dr. Kuper at an exclusive restaurant, one he could never afford on his scholarship. When he told her he needed to talk, she insisted on lunch, as a graduation gift to him. The kindness made him feel worse, and reminded him of the possibility he would not graduate.

In frustration and confusion, he blurted out his request. "I need access to the Medical School Library. The undergraduate level access on my computer is not adequate for my senior project."

"That's easy to arrange," she said. "Explain why you need Professional Medical Library access."

He had rehearsed his answer a dozen times. Suddenly, he could not bring himself to respond. He pretended to study the room. Local fish of pastel colors swam in the ponds that circled the tables. Their peaceful drifting did not settle his mind at all. He couldn't explain.

Kuper filled the silence. "Genetic research on cell walls is not an adequate reason to give to the board."

He fidgeted and then said, "I need to do some research into bipolar affect disorder, also known as manic-depression."

The doctor's face clouded over. "I see. I suspected as much. How did you get Raya's records?" Then she waved off his answer.

"No," she said. "Don't answer that. I shouldn't have asked. Of course we're talking about Raya. You two have taken a few of my classes together, but how did you diagnose her problem? The medical history books say it's difficult for even an expert to recognize."

Haydon nodded. Four years ago he had met a young human woman of strong moods. Little by little, his concerns had grown. After a while, he noticed that her "down" moods were too deep. By a year ago, he was aware that her "up" moods were as frantic as they were creative. Then, she rejected Mac. "She's gotten a lot worse," was his restrained answer.

"I see," Kuper said. "Let's talk about the early stages of the disease, often called Type II, since it was recognized after the full-fledged disease, Type I bipolar affect disorder, was identified. In Type II the manic stages can look perfectly normal, especially in brilliant college students. The person seems to function in an exceptionally competent way. They never seem to need food or sleep like the rest of us. They have endless energy and appear to be happy and successful.

Haydon picked up the diagnostic theme. "Then, still only suffering from Type II, they dive into depression. This does not cause undue concern from friends or family. Anyone can suffer a depression, especially college students who have problems ranging from academics to parents to young love."

Kuper smiled. "I see you've been reading all our old texts on the disease. You also noticed a change in the patient. She got a lot worse."

Haydon looked into his glass, embarrassed by his enthusiasm over diagnosing such a horrible disease. "I used to see Raya almost every day. My foster brother, Mac, and Raya are very close. Her mood swings have become much worse. I really think her disease has progressed beyond Type II manic-depression. Her manic stages are mean and dysfunctional. She is frantic, angry, irritable, and goes into wild rages at the smallest obstacle. She regularly throws temper tantrums at Mac. Mac is devastated."

Haydon sought a way to explain. Mac was not a human child and did not, emotionally, act like one. He had lost his parents and not suffered half this much. But he would die of starvation if Raya continued to reject him.

Haydon shrugged and fumbled out a few words. "Apparently, his alien personality is one that absolutely cannot tolerate a friend's ostracism. Raya's verbal attacks on him are tearing him apart. She screams, throw things, and verbally abuses him. He comes home destroyed and unable to eat."

Haydon took a deep breath to put more of the situation into words. "Mac knows, as he puts it, that 'her brain has a broken part,' but that doesn't change the strength of his response. I'm actually afraid he'll die of starvation. The only thing I can do to help is to cure her. My college computer network isn't adequate."

"I see," Dr. Kuper said.

Haydon had expected ridicule for his outburst, but she met his summary with an attempt at further clarification. "Your foster brother is that fuzzy little engineer/computer genius all the engineering professors are gloating about."

Haydon nodded.

"And, he's your roommate." Dr. Kuper seemed to think back for a moment. "He's also Raya's best friend," the doctor continued. "Almost her only friend, especially this year when her manic fits have become too much for the rest of the students to tolerate. And her depressive swings have locked her in her room without energy enough to open a book."

Haydon nodded again.

"Does Mac know," the doctor continued, "that she tried to commit suicide recently?"

"I didn't know," Haydon said, "but I'm not surprised. I bet he does."

The doctor huffed. "Does Mac know what you are working on?"

"Mac doesn't know a thing about my research. Neither does Raya."

"Good," Dr. Kuper said. "We really need to keep it that way. Since you've figured out so much about Raya already, I'll trust you with further information. Then both our necks will be in the noose."

Haydon nodded and listened as Kuper described how staff doctors and college professors had tried to talk to Raya's parents about her suspected manic-depression.

"They've threatened the staff into ignoring the whole thing. They're very influential people and they're in denial. The worst thing a parent can hear about their child is that she has a mental illness. They've convinced Raya that she's fine."

"But she probably can be cured," Haydon said.

The doctor shrugged. "I know that. You know that. I guess the stigma of mental illness never has gone away, despite all the medical advances."

They both sat with their thoughts for a moment.

Dr. Kuper shrugged. "If I get fired, I'll just have to retire early. It'll give me time to write those books I've been planning."

She studied Haydon. "About your

computer access, we will simply tell the Alliance that you have discovered an unresearched pathological allele and want to find how it causes cell failure."

"Fine by me," Haydon smiled, knowing that he had just allowed the doctor to stretch the facts.

"Then it's time for dessert." The doctor waved up the menu from the center of the table as Haydon objected.

His objections didn't last very long. He couldn't resist a piece of chocolate macadamia nut pie, as long as he could take half to Mac. Haydon made sure he saved the biggest half.

The new net access gave him new data, but not enough. He now knew that the problem was in the ion channels of the cell walls. The holes to let ions in and out of the cell, a process necessary to fire the neuron, were not working right. Then he was stuck. They looked totally normal. They opened and closed like any other ion channels. But they did not fire the cell. He ran his simulation comparison for the umpteenth time, and the channels failed every time.

He was so lost in thought that he jumped out of his chair when Mac blew up his latest computer construction.

"Sorry," Mac muttered, and flopped down on his mat.

Haydon sat back down and checked his computer. Nothing had changed. Raya's cells sat there, looked totally normal, and refused to fire.

These cells functioned like off-and-on switches. If they did not fire, Raya got stuck in her emotional state. She could get stuck in an "on" or manic state or she could get stuck in an "off" or depressed state. She was not in control of changing her mood to fit the circumstances. *But why won't they fire?* Haydon's brain yelled.

He put his head in his hands, hissed out a breath, and let his fists fall onto the desk on either side of the computer controls. He'd been stuck at this point for two weeks. Time was almost up. They would all graduate in two more weeks.

One side of his screen showed the simulation of Raya's brain cell walls. The other side of the screen displayed a normal comparison. Both sets of neurons looked absolutely identical, protein for protein, structure for structure. Both ion channels opened and closed the same way and at the same speed. But Raya's cells did not fire.

He twisted around toward Mac, who had turned his computer off and was tucked in a tight ball. "Let's go get some dinner," he said.

"Not hungry."

"Neither am I. Sometimes it's better to force yourself," Haydon said.

"I will throw up."

"Maybe I will too," Haydon sighed, "but I need the company. Please come."

"No," Mac hissed. He turned away and huddled up, as far away as his small pallet allowed.

"I'm sorry, Mac," Haydon answered the brittle silence, and returned to his computer. He could not face dinner alone.

After several more long hours, Haydon's eyes blurred and crossed. So few days left. His stomach cramped. He let out a groan and bent forward in his chair, eyes closed, arms wrapped around his belly.

"You not eat or sleep good enough either," he heard from Mac's corner, where he thought his little brother was asleep. "Now, I say, we go find milkshakes."

"Chocolate?" Haydon asked. He rocked a little and sat part way back up.

"Is there other flavor?" Mac said. "Except, possibly, chocolate with nuts."

Haydon started to turn his computer off.

"No," Mac said and moved to look at Haydon's screen. "Leave computer on. We come right back and work together. You grouchy, grumpy, stuck on structural design. I fix structural design soon. Then maybe you quit silly project and fix Raya. First, chocolate."

Haydon stood and batted Mac lightly over the head. *Why not let him help*, he thought. *I'm stuck on a structural design. He's an engineer. What's the harm in letting him compare two ion channels?*

Mac settled his plate of brownies on the largest of the painted wooden boxes. He wound his flexible body into his cushion and transferred his chocolate shake to his middle set of paws. "Now," he said, "send pictures of tunnels to my computer."

Haydon almost grinned as he transferred the "tunnel pictures" to Mac's Tri-D equipment. In a moment, both cell walls with ion "tunnels" were suspended as holograms in the middle of the room.

Mac enlarged the picture until the ion channels filled the space. He made the ion channels open and close, just as Haydon had done a hundred times. "Good engineering design." Mac cocked his head. "Why are they different?"

"I can't see that they are different, Mac. What's the difference?" Haydon's voice shook. "I beat my brains out over this for two weeks, and you see the difference in two minutes? Explain, please."

"First," Mac said, "show me what you want to send through the tunnels."

Haydon found it hard to breathe as he asked his computer to create scale models of the salts, the ions, which where supposed to pass in and out through the ion channels to fire the neurons. He sent the models of the atoms to Mac.

"Problem is too simple," Mac said. "Watch the lumpy balls."

The lumpy balls, the ions, passed easily in and out of the normal channels. The ions caught at the entrance or exit of Raya's channels. Her channels were a fraction, a tiny fraction, too small.

Haydon covered his mouth and breathed, "It is simple. I can't believe it."

"It would be best," Mac said in a tone that indicated the engineer's disgust with so obvious an error, "much best, to build bigger tunnels in the first place. But, you can make smaller lumpy balls. They will pass through the smaller tunnels."

"You better believe it," Haydon said. His brain filled in the rest. They can substitute the smaller atoms of lithium carbonate for the large ions of sodium chloride. It was the first treatment, the historical treatment, for manic-depression, from a very long time ago.

Back on his own computer, he made simulations of lithium carbonate ions. The chemicals moved in and out of Raya's channels with ease. The neurons fired.

He tried it three times before he wrote a note and sent it to Dr. Kuper.

"Oh, Mac," he said with glee as he sent the note off. "You did it." He dropped down to the floor and hugged Mac with gusto. Then Haydon noticed the plate of brownies beside Mac. They looked untouched. He carefully felt around Mac's arms and ribs. "Oh, Mac," he repeated, this time with great sadness.

He stroked the skinny arms. "I have to go see Dr. Kuper, my academic advisor. I have to tell her what I've . . . what you've discovered. Try to eat and get some sleep. Please?"

Mac looked down at the brownies with disgust.

Haydon hesitated at the door. He was almost afraid to leave Mac alone.

By the time Haydon arrived, Dr. Kuper had projected Raya's abnormal neuron onto her screen.

As Haydon collapsed into her old lounge chair, she sent the lithium carbonate ions through the simulation of the neuron. The neuron fired and then began to grow dendrites. The cells not only worked; they grew. "It's an ancient treatment for manic-depression," she said. "I'm so surprised you discovered it. Just a salt with ions smaller than sodium chloride."

"One reference called lithium a 'substitute for table salt,'" Haydon said.

Kuper turned to him. "I've already alerted the College Medical Board. They are ready to hear your report. I can only guess what they will decide."

"A meeting now? This time of night?" Haydon felt panic at the idea of presenting his research to the board.

"I want you to prepare for the worst. They'll probably refuse to accept your suggestions. They'll be horrified at the thought of giving Raya a medication for her illness."

"You mean, they might deny therapy to Raya. I thought, once her dysfunctional gene was identified, they would be thrilled to start treatment immediately. It's nothing but an error left from her prenatal testing. Somebody, before she was even born, failed to notice a DNA transcription error. She can take lithium carbonate for a couple of weeks, while her DNA is corrected. It's such a tiny disorder. Genetic engineering can repair something that simple before the college year is over. I bet she wouldn't even miss a day of classes. They can't deny her treatment."

"Come on," Kuper said. "I hope they agree with you."

She came out of the boardroom and approached him slowly. From her sagging shoulders, he knew the answer.

"They denied your request," she said. "Raya won't be told about your discovery or that it pertains to her."

He closed his eyes as if this would stop him from hearing. When he opened them again, he could see the effects of the long meeting on the professor's aged face.

"They decided *not* to tell her," she continued, "on the grounds that your data was acquired illegally, without the subject's permission. More significant, you did not have her *parents'* permission. No one is to know that your research was on her DNA."

She sat down beside him. "I repeat, no one must know. Your data will be published as a project done by, and I quote, 'our top pre-med student of the year, who found an allele which had never been researched.' They recommended you for *the* scholarship of the year, for xenomedical school on Hospital Space Station 10 of the Medical Alliance."

The emotions generated by achieving xenomedical school backfired. What should have been happiness just intensified Haydon's feelings. His frustration was beyond his control. "What's the point of my research," he yelled, "if it isn't used?"

"Haydon, quietly please. Your research was exceptional. Don't destroy all you've achieved tonight."

He shook his head and changed to a harsh whisper. "I can't go to some space station for medical school. I can't leave Mac in this condition. He's literally dying of starvation. Something in his fuzzy alien neurology destroys him if a friend rejects him. Don't you understand? I did this for Mac, not for Raya or for myself."

Dr. Kuper got up, put her arm around Haydon's shoulder, and led him out into the night. "I know. He's already had one IV feeding earlier in the week. We promised not to tell and worry you. It was about three days ago. He was treated and released. If he doesn't gain weight, he'll be hospitalized and force-fed."

Haydon froze in the path. The lights of his dorm glittered off the pond near his dorm. His whole vision seemed a bit blurry in the orange streetlights.

"That won't work," he said. "He'll die anyway. You can't force-feed him forever."

The doctor's grip on Haydon's arm tightened. "We won't let him leave this planet until we can reverse his condition."

"And I won't leave him alone until he's fully recovered. The board can take their scholarship and shove it." Haydon shook his head and spoke more softly. "I'm sorry. You don't deserve my wrath. You helped me every way you could. But I mean it," he continued. "I won't leave Mac like this."

"Go back to the dorm." The doctor shoved him gently in the direction of his building. "Try to get some sleep. The guilt now falls on the board. Let them be the ones who stay awake all night."

He could not face going straight back to Mac. He walked away from the campus center to the wilds of the rain forest. He circled the edge of the campus for hours trying to calm down and to figure out what to do next. His legs felt like lead, but he could not sit down.

During his wanderings, one security guard treated him like a drunken partygoer. He was urged and directed toward his dorm. When he looked around, he realized that he was on the far side of campus. On the way back, he began to think about sleeping on the grass. When he felt like he could not stand up one second longer, he found his building.

He collapsed into bed without taking his clothes off and prayed he would fall asleep. Instead, he tossed and turned enough to wake Mac.

"Not good?" Mac asked sleepily.

"Not good enough," Haydon said, sick with not being able to explain.

He couldn't wait for Raya to wander in for treatment. She had to be treated now. Mac had to be treated now.

Haydon got up, dropped onto Mac's small sleeping mat, and curled around him. He stroked the fuzzy head like he used to do when they were young misfits on the farm.

"Mac," he said in a whisper, "I have a long story to tell you and it ends with *you* taking *Raya* to the hospital tonight."

Haydon fell asleep the moment Mac left. The call from the emergency room awakened him. He arrived at the ER out of breath and spotted Dr. Kuper immediately. He opened his mouth to speak, but she signaled him to silence.

"Mac," the doctor said, "is in the first cubicle getting a bit of emergency treatment."

"No." Haydon pictured the worst.

The doctor dragged him to a chair. "Sit down and listen for a minute. He's going to be fine and so is Raya. They arrived together about twenty minutes ago. They both asked for treatment. Both are doing well."

"Can I see Mac?" Haydon got up again.

"Only," Dr. Kuper said, "after you listen to me."

Mac had a candy bar in one had, orange juice in another, and pudding in a third. A fourth hand held a spoon full of the pudding.

"Remember," the nurse said, "eat slowly. The goal is to keep this inside you."

"I am so'o'o hungry," Mac said, but took little bites and paused a moment after each.

Haydon just stood and leaned against a boring pale green hospital wall, the prettiest color he had seen in months.

"Raya is fine too," the doctor said. "She's talking about applying for art school on Arthien."

"Art school?" he asked. His brain did not seem to be working well enough to skip from Mac's eating, to Raya's treatment, to Raya in art school. "On the planet Arthien?"

"Exactly," the doctor answered.

"Where Mac is going for his engineering graduate work?"

"Two rights in a row," the doctor smiled. "It seems that medical school was her parents' idea all along. She's taken every art course allowed in a pre-med schedule. Of course, she'll be a year or so behind her art classmates. Her recovery's going so well already that . . ."

"On only lithium carbonate?" Haydon asked. "Isn't it slow to bring about changes in emotional states?"

"Oh, we have a few more tricks than that these days. Lithium alone would be slow. She's on another drug as well. One that relaxes the ion channels a bit. Those channels are now large enough to use normal ions. And, we've already regenerated a few of the brain cells you identified as the primary problems. Changing her genes will take a few weeks, but she will be fully recovered with plenty of time to get settled on Arthien before the next semester begins."

"In art," Haydon said again. "And Mac will still have his little mother to watch over him."

The doctor nodded. "Your brother is one brilliant little kid. I hope we find his planet some day. A bunch of little Macs could be quite useful, even though it might strain the galaxy's chocolate supplies."

Haydon nudged the doctor to the far side of the room and asked, "Why am I not in trouble with the board? You know I told Mac everything, after they ordered me not to."

"The board doesn't know that," the doctor said. "They think Mac arrived here with Raya without a bit of urging from you."

Haydon shook his head in disbelief.

"Do you remember that security guard who talked to you while you staggered around campus?"

He nodded slightly.

"He swears you were with him when Raya and Mac arrived here. He swears, before that, he watched you wandering around alone for hours. He swears that you could not have talked to either Mac or Raya."

"But I—" Haydon started.

Dr. Kuper waved him to silence. "You'll agree with his sense of time, won't you? That guard is a good friend of mine. We both arrived here more years ago than I want to count. Would you make a liar out of that old man, a good fellow with a spotless record, so near to his retirement?"

Haydon tried to answer, but was interrupted again.

"Of course you wouldn't accuse him of having a bad memory. You wouldn't want him to sound like an old idiot, maybe suffering from some kind of senility, unable even to tell time. You wouldn't want him to be forced into retirement before he earns maximum benefits, would you?"

Haydon dutifully shook his head.

The doctor continued. "As far as the board is concerned, the timing is damn suspicious. But Mac's condition was so critical that Raya had to bring him in for help.

"She understands that her irrational behavior was the immediate precipitator of Mac's illness. She asked for the help for both of them. She felt that, if he died, she would definitely commit suicide. She was already suicidal when she arrived. No emergency facility would deny treatment under those circumstances." The doctor was grinning like the Cheshire cat.

Haydon felt confused, but tried to see the logic.

"That's the word of the admitting doctor," Kuper continued. "He said that both Mac and Raya requested and needed emergency care immediately."

"But why did you treat her now?" He did not want to ask for fear the wrong word would dissolve all the good wrought this evening. "Everyone was afraid to even mention her illness last year."

Kuper spoke very softly. "Because she asked. She never asked before. Although she's not quite of full legal age, her request, that of a young adult at this college, carries more power than anything her parents could do in retribution. Besides," Kuper said, and flinched as she stretched her back, "she did not implicate you. She was so careful. She didn't request any particular treatment. Just help."

"She's a good person," Haydon said, "or Mac never would have chosen her for a friend."

"I agree. A wonderful young lady with a nasty disease."

"And I'm actually going to medical school on Emergency Space 10?"

"You will, in less than three weeks. You'll be shipped off to the most pathetic hospital in the galaxy. The thing is liable to disintegrate any minute."

"Full of aliens," Haydon stammered. "With a fantastic teaching staff."

"Whatever makes you happy," the doctor said, and shook her head. "Right now, make sure Mac doesn't overeat. I'm too old to stay up this late."

Mac and Raya had taken charge of packing. They kept stuffing more of Mac's projects and Raya's art into Haydon's bag.

"Stop," he said. "I have a twenty-pound weight limit."

Raya took the bag and weighed it, removed some clothes and crammed in a small painted box.

Haydon groaned. "Mac," he said, "what will you do if Raya gets a boyfriend?"

"Pester him to buy me brownies and take us for swims, just like I did to you. I liked all your girlfriends, especially Posha."

"She's the one," Haydon explained to Raya, "who made chocolate-covered candied papaya."

Raya giggled. "I'll have to get her recipe. Mac and I will be here another few weeks." She picked up the bag and began to remove another one of his shirts.

"Stop that," Haydon yelled, grabbed the bag, pulled it closed, and threw it over his shoulder. "I need something to wear."

"Well, hurry up then," Raya said, and pushed him. "You took so long packing that you'll have to run to meet your shuttle."

"I . . . my packing," Haydon stammered.

"You mustn't miss the space shuttle to xenomedical school," Mac said. "You need to learn to fix people faster. You took too many months to fix Raya."

Haydon sputtered, but could not find a single answer to Mac's sarcasm. He hugged them both and thought about the new lives they were all about to begin. ■

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EQUIVALENCE PRINCIPLE

Robert Scherrer

If economics is the dismal science, then surely metrology is the boring science, thought Edward Melton as he crumpled his empty Cheetos bag and tossed it into the trash can in the corner of Professor Witherspoon's laboratory. And was a Ph.D. project really supposed to take ten years? A decade of tinkering with Witherspoon's atomic clock, working on a dissertation which always seemed just another year away.

A knock at the door jolted Melton upright. Dewey Witherspoon stepped into the lab, sporting plaid shorts and a red baseball cap, perched rakishly atop a shock of blond hair. His blue eyes twinkled as he swished the air with his tennis racket. "Melton," he said, "I'm off to the Faculty Club for a tennis date. Have you fixed the problem with the clock yet?"

"I'm still working on it. I've been doing some calculations—maybe the clock isn't broken—"

"Not broken? Gold atoms don't just suddenly disappear, and atomic clocks don't run fast unless they're malfunctioning. There's clearly a problem, so please fix it. I'll be back later today." Witherspoon stepped into the hall, then stuck his head back through the doorway. "Melton, you look like hell. You need to get out more, like I do. Get some exercise." Witherspoon's head disappeared, and Melton could hear him humming "Happy Days are Here Again" as he strolled down the hall.

Melton opened his notebook to recheck his calculations. A steady diet of partially hydrogenated soybean oil, washed down with vending-machine hot chocolate, had transformed his body into something resembling a sphere, so he had to sit back from the desk and lean forward to read his notes. He glanced sideways at the massive metal cylinder in the center of the lab. The microwave cavity of the atomic clock rested above a spaghetti bowl of cables and circuit boards—his constant companion for the past decade. Hell, he'd spent more time with the atomic clock than he had with Professor Witherspoon. "Well, Ingrid," he said to the clock, leaning over to pat the side of the cylinder, "let's see if we can figure out what's wrong with you."

Witherspoon's project had seemed simple at the beginning. Most atomic clocks used the hyperfine transition in cesium, but any element with only a single electron in the outer shell would do just as well—people built clocks that used hydrogen or rubidium. Witherspoon had come up with the bright idea—as far as Melton could tell, the only original idea he'd ever had—of using other elements, stripping off the electrons until only a single electron remained in the outer shell, and then pumping the ionized atoms into the microwave cavity of the clock.

The first few elements had worked fine, but every time Melton wanted to write up his dissertation, Witherspoon had insisted on trying "just one more element." Eventually, it seemed like he wanted to run through the entire damn periodic table. Every month brought a new element, a new set of data, a new roadblock between Melton and his Ph.D.

The only consolation was that they would eventually run out of elements—Melton had already purchased a lab notebook and inscribed the cover with "Uranium." He kept it in the linen closet of his apartment, next to an unopened bottle of champagne.

But when they got to atomic number 79, gold, the experiment went haywire. The clock ran twice as fast as it should have, and the gold atoms seemed to disappear from the microwave cavity. But what was special about gold? It was the most ductile element, and an excellent conductor, but none of that seemed relevant. Melton laced his fingers behind his head and leaned back to think. The boring science, the dismal science, the boring, dismal science. Suddenly his eyes widened, and he began scribbling furiously in his notebook.

Melton scurried down the hall and burst into Witherspoon's office. "I've got it, Professor Witherspoon! I've solved the problem. We'll be famous!"

Witherspoon glanced up from his copy of *Golf Digest*. "What is it, Melton? I'm quite busy."

Melton sketched a wavy line on Witherspoon's blackboard, filling the air with a haze of chalk dust. "Physics over the last century," he said, "has been all about developing equivalencies between apparently disparate physical quantities." Melton coughed to clear the chalk dust from his throat. "Quantum mechanics gave us an equivalence between particles and waves. We know now that they're simply two different aspects of the same thing."

Witherspoon's gaze wandered toward the door. Melton hurriedly erased the board with his shirt-sleeve and scrawled a ragged line of equations. "And of course, Einstein was responsible for two of the most important of these relations: space and time are related through the speed of light, while energy and mass are related by $E = mc^2$. In string theory, the Maldacena conjecture suggests an equivalence between space and matter—"

"Get to the point, man," said Witherspoon. "I don't have all day. I'm meeting a colleague for drinks in half an hour."

"I think what we're seeing here is another fundamental equivalence, at least as important as any of these." Melton stared briefly at his feet. "The gold atoms are disappearing, and the clock is running fast. I think the gold atoms are being transformed into time."

"What?" Witherspoon rubbed his forehead for a moment. He opened his mouth, then closed it, then opened it again. "You can't mean—"

"Exactly." Melton grinned and tossed the chalk into the air. "Energy is mass. Space is time. And time *is* money." ■

ODDS AND ENDS #3

Since this is an "Odds and Ends" column, you can expect me to be all over the place this time out. For those of you who don't know, every now and then I do a column which consists of short takes on matters pertaining to my earlier columns, or to other matters appearing in this magazine, or to current events, or to just about anything else that I want to gas off about, but not for an entire Alternate View.

First up, see if you can figure out what the "mystery thing" is from the following paraphrase of a passage I read from a book (hint) published in the 90s. "Persons who are occupied with other branches of science or philosophy, or with literature, and who have therefore not kept quite abreast of physical science, may possibly be surprised to see the intimate way in which (blank) is now spoken of by physicists, and the assuredness with which it is (searched for). They may be inclined to imagine it is still a hypothetical (thing) whose existence is a matter of opinion. Such is not the case. The existence of (blank) can legitimately be denied in the same terms as the existence of matter can be denied, but only so. The evidence of its existence can be doubted or explained away in the one case as in the other, but the evidence for (blank) is as strong and direct as the evidence for air." As additional hints, this book was written by a leading British physicist, and is a textbook for physics majors.

I'll return to reveal the answer to this mystery at the end of the column, so don't peek!

In a recent column ("Only On TV," Sept., '03) I was critical of NASA for its cavalier attitude toward the safety of the astronauts aboard the ill-fated *Columbia*. Granted, I wrote that column only weeks after the tragedy happened, and my feelings were raw. For me, the *Challenger* disaster of 1986 remains a vivid memory, and those astronauts, it turns out, did not have to die. The booster problem was known and should have been corrected, but it took a calamity to shake the agency out of complacency. So when the *Columbia* came apart over Texas, I did not want to believe that NASA had once again given complacency too free a hand. But the explanations coming from the top about how there was nothing anyone could do rang hollow from the get go. Hence, the bitterness of the earlier column.

Has time changed my feelings any? No. If anything, I'm even more ticked off. Here's why.

Early in June, I came upon this Associated Press report written by Marcia Dunn. My local paper (*The Grand Rapids Press*, June 5, 2003, pg. A13) had the headline as follows: "Impact of Foam in Test Shot Amazes NASA Investigators." The first paragraph reads as follows: "A 1 1/2-pound chunk of space shuttle foam hurled at a fiberglass wing replica struck with enormous force and deformed some of the pieces, to the amazement of the *Columbia* accident investigator in charge of the testing." So, this was deemed "amazing." Hmmm.

One Scott Hubbard, identified as a high-ranking NASA official on the investigation board, is quoted as saying, "People's intuitive sense of physics is sometimes way off. You don't feel that this (foam) can do anything." You don't *feel?* Double hmmm.

As I recall, we were told right after the accident happened that the NASA engineer types had looked at the foam insulation impact on the wing of the shuttle and determined that there was no danger to the shuttle.

On what basis, pray tell, was this determination made? Since the very first test made using a foam projectile and a mock-up of the wing demonstrated that significant damage could occur, we must conclude that no such test was performed prior to this shuttle mission. Otherwise, the engineers would have known that damage might have happened. Apparently, no such test was performed before this accident even though the shuttle had been hit by falling foam on other occasions. So the determination made by the engineers was pure eyewash, moonshine . . . bullshit, if you will.

In late June, NASA said they might start sending up shuttles again in December or early 2004. One can only hope we've reached the end of the bullshit. I doubt it.

Heads should roll.

I noticed in the July/August 2003 Brass Tacks that Stan got quite a load of letters concerning his editorial on Intelligent Design (from the February 2003 *Analog*). I don't particularly want to wade into the details of the arguments—for me, it's all "been there, done that." I was raised in a Christian home and learned early on that Genesis is not a science book (I arrived at 90% of my current understanding of the issue by the time I'd left eighth grade). In my tenth grade biology class at Calvin Christian High School, we were taught evolution just like biology students in the public schools. And regardless of semantic distinctions about what is a Theory as opposed to "just a theory," evolutionary theory is what biologists use, and Creationism is not. (Note: By Creationism with a capital "C," I mean biblical literalism with respect to Genesis. Lower case creationism, to which I do subscribe, accepts God as Creator, but doesn't treat the Bible like a science text and accepts science as the means by which the physical universe is explored.)

I'm jumping into the discussion now because I don't think Intelligent Design should be confused with Creationism. Granted, some Creationists want to make God the Intelligent Designer, but as any science fiction reader should ask, couldn't it be aliens instead? Indeed, I think some form of "intelligent design" theory *does* belong in the classroom, and here's why.

It is certain that the physical laws of the Universe are sufficient to support life such as we are, otherwise we wouldn't be here. However, it (1) does not necessarily follow that those laws are sufficient to *produce* life like us, and (2) even if they are, it is not certain that the early Earth was an adequate breeding ground. If we accept from point 2 that the Earth could not produce life, this does not immediately lead to a Designer. It does leave open the chance that life started elsewhere "all by itself," and was seeded here later. And on point 1, even if life like us could not start "all by itself" anywhere in the Universe, this also doesn't lead automatically to God. Perhaps physical laws allow for the development of intelligent life unlike us (electromagnetic beings or some such) that then designed life such as us.

My point is not that I think evolution needs to be challenged as just one of many other theories. It is, after all, the biggy in biology, extensive knowledge of which is mandatory if one wishes to pursue a career in biology or any of the related fields (anthropology, paleontology, etc.). But all big theories rest on certain assumptions that it would be nice to turn into facts, and for evolution, one of those assumptions is that life can originate from non-living matter. In my opinion, modern science education tends to undervalue the teaching technique of considering the alternative. If we deliberately point out that alternative assumptions exist, this prohibits the mistaking of an assumption for a fact, and starkly highlights those places where more work needs to be done. Creation science, with its obvious ties to religion, is unwelcome in the public school classroom, which renders it unsuitable to be used as that alternative. But modern Design theory *does not* (as I showed above) need to be tied to religion at all, and so can serve.

Granted, the question remains open as to whether or not, say, electromagnetic beings could self-originate, but at that point we're no longer dealing with *biological* evolution. And anyway, the question of ultimate causes is essentially religious in nature and this is so whether you're an atheist or not.

I also noticed that of the seven letters Stan printed concerning his Intelligent Design editorial, he only actually replied to one. How is the letter writer, or any of the readers, to interpret what it means when a letter appears without comment? I can't answer for Stan, of course, but in my own case, there are several reasons why I might deliberately decide not to offer a reply.

One reason for not supplying a reply is that some letters are fine just the way they are. That is, they say something that needed to be said, or they offer a different, but equally valid, viewpoint to my own, or they add something that I wish I would have included. In these cases, I don't want to muck up the letter by penning a reply to it—these letters can stand alone, and I'm content to let them do so.

Another reason is something like the opposite of the above. Now and then—and fortunately, rarely—a letter comes in that is so stupid or mean-spirited or flat-out farcical that it is self-discrediting. In these cases, a reply serves no purpose since the contents of the letter itself reveal more about the letter writer than they do about the supposed sins of the author. Put in a more pithy way, some people are assholes, and (this should be one of Niven's Laws—see the November, 2002 *Analog*) no intelligent person should get into a farting contest with an asshole.

And a third reason is that sometimes the task of writing an adequate reply is simply too overwhelming. Nice, well-meaning readers, with a particular point of view they'd like to get across, sometimes write letters filled with assertions masquerading as facts and idiosyncratic opinions poorly disguised as self-evident truths. If the letter deals with one of my hot button issues, the desire to reply is nearly impossible to resist. But to adequately address the points raised would require that one first expose the writer's assertions and opinions for what they really are.

This could take up several issues of *Analog* (entire issues, not just Brass Tacks).

So in this last case, I "just say 'no,'" and then get on with other work.

Now, back to that passage I started with. Did any of you think the author was talking about dark matter? That's what it sounds like to me. After all, most astrophysicists are confident that some kind of dark matter exists—they've been spinning theories about it for most of my adult life. Even though no one as yet has actually *found* dark matter, the observational, though indirect, evidence of its existence is accepted as firmly established.

But the passage is not about dark matter. I pulled a fast one on you. The book does come from the 90s, but by that I mean the *1890s*. It is *Modern Views of Electricity* by Oliver Lodge (later to be Sir Oliver Lodge) and he was talking about the ether (or *aether*, as I prefer). Lodge wrote with such confidence, yet within twenty years, his era's mainstream view of the ether would be banished, even though the empirical evidence leading to his confidence would go unchallenged.

The passage caught my eye because I think those who today write with equal confidence about dark matter are destined to find themselves in the same boat with Lodge a few years from now. I don't dispute the validity of the observational evidence that leads the modern astrophysicist to infer the existence of dark matter. I just think that appeals to various forms of mystical matter to supply the extra gravity needed to explain the observations is misguided, and this will be obvious to everyone once we have a fuller understanding of galactic structure as the result of *electrodynamic*, as well as gravitational, forces.

But that's a subject that deserves a column all to itself. ■

ANALOG
SCIENCE FICTION AND FACT

CONGRATULATES
THE WINNERS OF THE 2003
HUGO AWARDS

Best Novel
Hominids
Robert J. Sawyer
Analog, January-April 2002

Best Novella
"Coraline"
Neil Gaiman

Best Novelette
"Slow Life"
Michael Swanwick
Analog, December 2002

Best Short Story
"Falling Onto Mars"
Geoffrey A. Landis
Analog, July/August 2002

Best Related Book
Better to Have Loved: The Life of Judith Merril
Judith Merril & Emily Pohl-Weary

Best Dramatic Presentation: Long Form
The Lord of the Rings: The Two Towers

Best Dramatic Presentation: Short Form
Buffy the Vampire Slayer: "Conversations with Dead People"

Best Professional Editor
Gardner Dozois

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Bob Eggleton

Best Semi-Pro Zine
Locus
Edited by Charles N. Brown, Jennifer A. Hall, Kirsten Gong-Wong

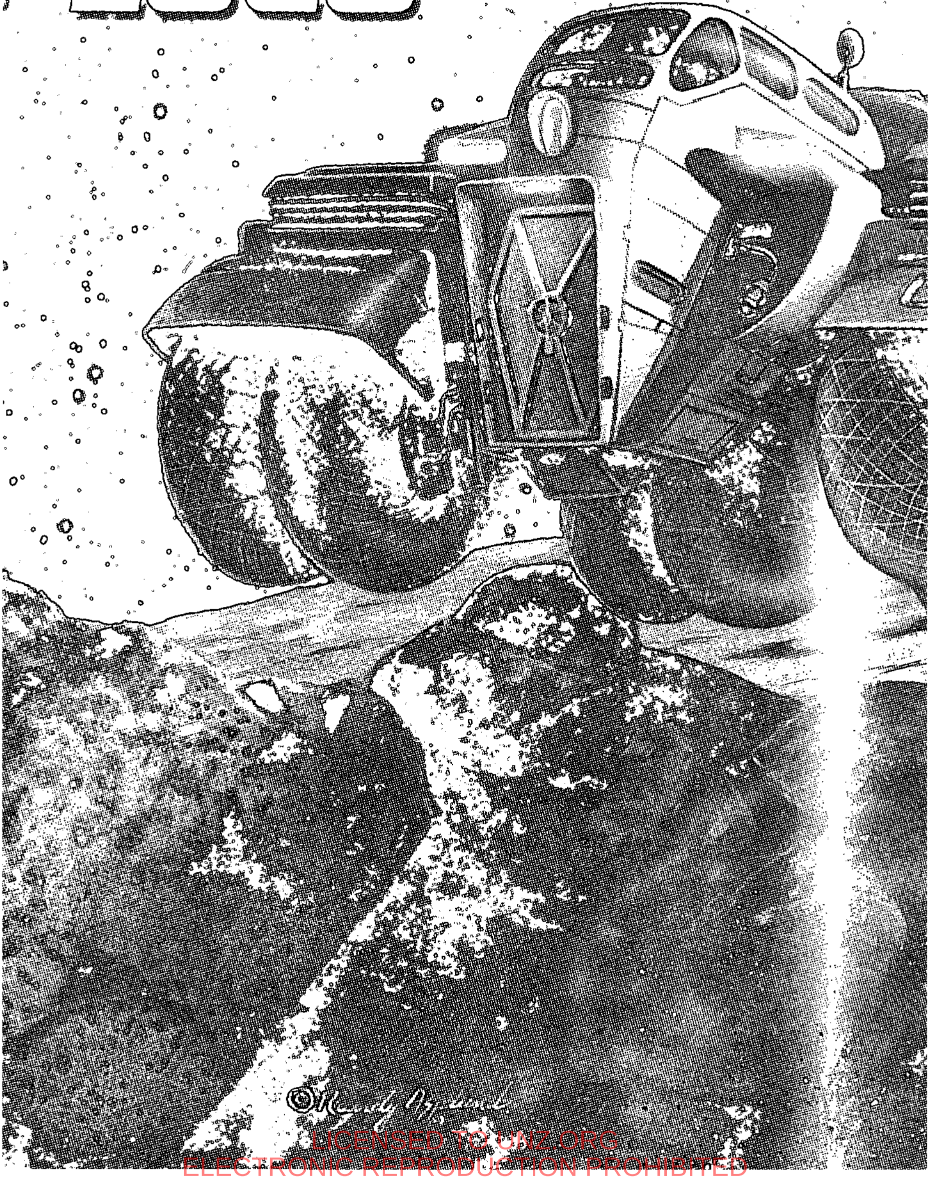
Best Fanzine
Mimosa
Edited by Rich & Nicki Lynch

Best Fan Writer
Dave Langford

Best Fan Artist
Sue Mason

John W. Campbell Award for Best New Writer
Wen Spencer

SHORT LINE LOCO



Stephen L. Burns

Illustration by Randy Asplund

Well, I suppose this *could* be considered a tall tale. . . .

The call came in the early afternoon, waking Kendra Zenna Joad out of a deep and well-deserved sleep.

She pawed blindly for the ACCEPT pad on the infone beside her bed, in the process knocking over the empty Ouzo bottle beside it, sending it rolling and bouncing away. Finally she managed to find the pad, bluish light from the screen brightening the small, dimly lit stone cubicle. The body beside her, which belonged to an electrician named Buddy Konstantin, squirmed deeper under the covers with a snuffle of protest.

"What?" she growled, her normally husky voice muzzy from sleep. Squinting blearily at the screen, she recognized Stanislaw Mazurowski, Luna Construction site heavy equipment and transport manager. Her boss.

"*We need you to come in immediately, Kaze.*" Most of her life people had called her Kaze. As derived from KZ, and as in rhymes with crazy.

"I just got off a few friggin' hours ago, Slaw," she groaned. "I need sleep."

"*I know. But we've got an emergency situation here.*"

That made her sit up straighter, stiff blanket slowly drifting down in the lunar gravity, leaving her naked from the waist up. "What kind of emergency?"

Slaw shook his head, looking pained and his eyes skidding off to one side. "*Just get in here, will you?*" he said hoarsely. "*Please?*"

Normally someone looking away from her like that would have pissed Kaze off, but this was Slaw. It wasn't her skin in particular giving him a problem, he had issues with naked women in general. Plus a couple of the tattoos and odd ring or two only made things worse. She knew he wouldn't have called unless he really had to. After a run, sleep was imperative.

Well, at least after a few drinks, and maybe some boogie to work out the kinks.

"Okay, I'm on my way," she grumbled, clambering off the bed—really just a thin air mattress on the floor—and kicking the infone off with a bare, stubby, beringed toe. Then she bellowed "*Coffee!*" at the coffeemaker. Knowing what was good for it, the device began chugging away.

While it worked up a cup for her she went hunting for her clothes. Separating them from Buddy's wasn't a problem, even in the dim light, and even though both of them had been dressed in job-issue cargo pants and quilted shirts the night before.

He was a 42 long, and she was a dwarf.

Her taking his underwear was not a mistake.

Fifteen minutes later Kaze reached the door to Slaw's office in Ops, one of the dozen along one of the first tunnels hewn out of the rock as part of the Luna construction project. She'd slugged down enough coffee to be mostly awake, but still looked rumpled and hung over, shirt only partly tucked in and orange-dyed hair standing out in raddled spikes.

"Kaze, you're here," Slaw said, stating the obvious as she pushed through the thin plastic door into his cramped cave of an office. He looked relieved she'd come—and come dressed—thin, pale features in a nervous smile.

"Yeah, I'm here." She nodded a greeting to the other people in the room, all but one of whom she knew.

There were three chairs in there, not counting the one Slaw had behind his desk. In one was Robyn Hampton, the rangy, dark-haired Canadian woman who was in charge of building Luna. Dave Broadbent, their brawny blond Australian flight boss, was huddled in a corner on the second, working with his pad and looking utterly pissed off.

The new face in the office was a very large black man in dark gray multi-pocketed coveralls. He perched uncomfortably on the edge of a steel and plastic slingchair, a big silver attaché case between his feet. When he saw Kaze his first expression was one of surprise. That quickly gave way to angry dismay. He opened his mouth to say something, then closed it again, his wide craggy face tight as a fist.

"Thanks for coming in, Kaze," Robyn said. "Slaw told us you just came in off a run. I know you should be sleeping—" A raised eyebrow. "—or whatever. But we've been dumped in deep shit here, and we need you to run the bucket."

Since there were no empty chairs left, Kaze went to Slaw's desk and hopped up to sit on one corner of it. That was a bit of a jump for someone who was barely chest high to it, but plenty of practice and the lower gravity made it easier. "What's the problem, guys?" she asked, stifling a yawn.

"There have been terrorist acts directed at this project of yours," answered the newcomer, his tone harsh and accusatory. He made it sound like he thought that was their fault.

Kaze did her best to ignore his attitude and keep her own in check. "Yeah? Who is it this time? Crater huggers?" Since the very start, several groups had declared their opposition to the construction of Luna and the Waterworks, the first permanent settlement on the Moon and an ice mine to help support it. While most of these crazies produced only lame rhetoric and vague threats, a bitter residue of the most fanatic factions had managed actual attempts to sabotage and cripple the project. They all did their best to ignore it and get on with their work.

"We think it's Earth Only," Robyn said.

"*We*," the immense stranger said, his emphasis on the word making it clear he belonged to a different—and far superior—we, "—are convinced it's them. Their vague press release could be discounted, but no other group has ever shown this level of sophistication."

Kaze cocked her head and looked him over. "Who the hell are you, anyway?"

He stared back. "Colonel Will Freedman."

"Special Agent of UNATIED," Robyn supplied.

That made Kaze frown. "Where's Lee Chen?" Chen was their usual UN Anti-Terrorism Intelligence and Enforcement Division watchdog. He spent most of his time up on the orbiting waystation Moth, making sure nothing and no one dangerous made it down to the lunar surface.

Robyn caught Kaze's eye. "Lee's dead," she said softly.

Kaze's face fell. "Shit. How?" She, like everyone else onsite, had been fond of the Taiwanese UNATIED officer. Twice a month, while on his scheduled inspection tour, he would cook for everybody. His specialty had been Cajun.

"He was killed to keep this plot from being uncovered," Freedman growled. His mouth tightened. "We're wasting time here, people. You have to get me to Ice Mine 1." His gaze settled on Kaze and his frown deepened. "This is the best you can do?"

"You want me to take this guy to the Waterworks?" Kaze said uncertainly, turning back to look at Slaw. "Why not use a hopper or mini-shuttle? They're a hell of a lot faster than my rig."

Dave Broadbent looked up from his screen. "All my assets are grounded, love. Part of the attack was doping the last batch of fuel catalyzer with some sort of stuff that causes the fuel to jell. We can't fly. Everything up on Moth has the same problem. The shuttle that brought the Colonel down nearly crashed when it tried to land. It isn't taking off again until we figure out how to fix the problem."

Kaze faced Freedman. "So why do you need to get to the Waterworks in such a hurry?"

"To prevent stage two of the attack," he replied coldly.

"Which is?"

He shook his head. "That information is classified. But I can tell you this: If I don't get to that ice mine ASAP this whole operation may well be history."

"Kaze," Slaw said, "I know it usually takes twenty-three hours for you to make the run. What's the fastest you could do it?"

She shrugged and rubbed her chin, thinking it over. "I don't know. I guess if I ran with four full cars or tanks I'd be pretty good on weight and stay-down. If I can draw full charges from all the waypoints I could maybe make it in eighteen hours."

Freedman got that angry look again. "That's far too slow!"

"Honey," Kaze shot back, "I don't fly a rocket plane, I drive a goddamned train. It ain't built for comfort *or* speed."

"Colonel," Robyn put in, "We don't have anything else with even that much range or speed."

He stared at her. "Maybe you have a better driver."

Robyn shook her head. "When our relief engineer makes the trip it takes him over thirty hours. Kaze is the best. She has loco in the blood."

Freedman turned his head to glower at Kaze, looking her over like a banana he'd been handed when he'd asked for a gun. "Are you sure she's really up for this?"

Kaze hopped down from the desk and marched up to him. Even with her standing and him sitting, she still had to tilt her head back to get eyeball to eyeball. She parked her small fists on her hips. "Listen, man, I don't know who kicked the board up your ass, but—"

That was as far as she got before Robyn and Slaw interceded, Slaw pulling her back and Robyn taking her place. "She's up for it, Colonel," the site manager said coldly. "You're the one we're concerned about. Because of your size it may not be possible for you to deadhead."

He shook his head. "Hard for me to what?"

"Deadhead. Ride in the engine cab. Which means we have to add on a passenger car just for you. A nearly empty car will slow her down. *You* will slow her down."

"Then I'll ride in the cab with her."

Slaw shook his head, looking apprehensive. "You're a pretty big guy, and there's not much room."

Kaze just grinned. "You heard the man. Deck his ass out in a set of boots and 'ralls." She glanced at the clock. "Train leaves in fifteen minutes."

Fourteen minutes later Kaze had completed her walkaround and let herself into Engine 1's cab by the forward noselock. She dropped down into the Engineer's heavily padded and shock-mounted chair. She pulled off her helmet and twisted around to check on her passenger.

"Comfy back there?" she asked sweetly.

"I'm fine," Freedman answered in a flat, toneless voice. There was a jumpseat at the rear of the cab, but it was clearly just an afterthought; little more than a shallow, thinly padded niche in the firewall between the cab and the engine compartment. Freedman was stuffed into it with his back bent and his knees up around his chin. The thickly padded equipment operator's 'ralls bulked him up even further, making the fit even tighter. Jammed between his legs was the silver briefcase he'd had with him back at Slaw's office.

"Here's the deal," Kaze said as she began her final check of the engine's boards. "This old mother rides pretty rough at the best of times, so you better hold your—" She hesitated, then looked up into the mirror which allowed her to see into the rear of the cab without turning around. "No bullshitting around, Colonel. This is going to be one ballbuster of a ride, and that seat's a killer. Let me have Slaw stick a passenger car in between two of the loaded cars. You'll be something other than wrecked when you get there."

He stared coldly back at her. "Just get

this thing moving."

"I'm trying to tell you—"

"I said *go*. Stop talking and start driving."

"Fine," she said with a shrug. "It's your funeral."

Freedman muttered something unintelligible.

"What was that?"

He shook his head. "Just get moving."

Earthly trains rode on a track, the shining (though more often rusty) steel rails of legend and song.

The lunar train's only track was the set of wide shallow ruts worn into the Moon's breast by repeated trips along the same route. While this path had become prominent enough to follow by sight alone—at least while the Sun shone—it was not the train's sole means of guidance. There were pea-sized transponders buried every thousand meters of the winding route between where Luna was being built and the Waterworks, which was up nearer to the north pole. GPS data and satellite imagery provided yet another means of navigation.

Like Robyn had told Freedman, the trip from Luna to the Waterworks usually took Kaze about twenty-three hours. When her relief driver took the run that time stretched to well over thirty.

Trying to do it in less than twenty hours was madness.

"*You're cleared for departure,*" Slaw said over the radio.

"Roger that," Kaze drawled into her pinmike. "Engine #1 rolling out."

The controls had already been pulled and locked into position around her. She took hold of the yoke and gently pushed it forward. The cab began to vibrate and the noise level rose as the two massive Clydesdale electric motors began to spin, turning the high-pressure pumps which in turn drove the fluidic drive motors on each of the engine's twelve independently operated drive wheels.

Slower than a snail getting up off its butt to take a leisurely crawl, the train began to creep forward.

"That's *it?*" Freedman demanded.

"We're on the Moon, bunky," Kaze called back. "Low gravity, right? If I dump full power into the wheels we hop straight up. A lunar train is female. It takes some foreplay to get her going."

Engine 1 bore little resemblance to its earthly cousins. It was a ten-meter-long flattened cylinder slung between six sets of two-and-a-half-meter-tall drive wheels. While it could pull as many as thirty cars, Slaw had set it up for this trip with only four cars in tow. Coupled directly behind the engine was a tanker, still full of water from her last run back. Behind that were three boxcars, each loaded with materials which were to go to the Waterworks on the next run anyway. All sat on the same sort of oversized basketwork wheels, though the engine's driver wheels were much more heavily constructed.

Those four cars were a small fraction of the weight Engine 1 could pull, and weren't much of a strain. Running without them wouldn't have enabled Kaze to go faster, but made her drive more slowly. To make any sort of speed she needed two things: mass, and the pusher motors atop each of the cars to help hold the whole thing down. Between the rough terrain and the low gravity, bounce was the enemy.

Slowly but surely the clumsy truncated centipede that was Kaze's train gathered speed. Once they were in motion she could goose it a little harder. The acceleration would never set anyone back in their seat, but compared to the usual roll-out they were drag-racing.

The ground-speed readout, which she had set to show miles per hour out of sheer American perversity, slowly rolled up past the 17 MPH which was the cruising speed she usually topped out at on the first leg out from Luna. It ticked upward, passing 20. The engine bucked and shuddered and yawed skittishly, riding like a shockless car over potholed gravel.

She leveled off at 23. Going that fast was going to keep her very busy, but it was the best this stretch would let her do.

She glanced up into the mirror. "You want coffee?"

He was taken by surprise by her offer. "Uh—"

"Your best bet is to say no. The coffee sucks, sleeping through the trip will be more comfortable and less boring, and you're wearing your bathroom."

"Are you having one?"

"Oh, yeah. And using it to wash down a couple StayUps. I've got to stay awake and alert. It doesn't help that I came off a run less then twelve hours before you got me out of bed."

"But you *can* stay awake?" he demanded.

"Believe it. Not only do I have loco in my blood thanks to coming from five generations of railroaders, I also happen to be a world class insomniac."

Freedman didn't look convinced. "I 'd better have a coffee too." His tone made it clear he thought he would have to stay awake to keep her awake.

"You'll regret it." She spoke an order for two coffees, one fore and one aft, into the pinmike.

They were two hours out from Luna. The uneven terrain and a series of switchbacks had forced Kaze to slow to around 18 MPH. The cab bucked and heaved and shuddered and swayed like a small boat on rough water. She checked on her passenger, frowned. Freedman didn't look well at all, his dark complexion gone gray and ashy.

"You okay back there?" she called. "You're not gonna barf, are you?"

"I'm fine." He forced the words out through gritted teeth.

"You don't look fine. Motion getting to you?"

"Maybe a little," he admitted grudgingly.

She spoke a command into her mike, then eyes on the track ahead, raised her voice again so he could hear. "There's water and a pill in the dispenser beside you. The pill is for motion sickness. You can't see shit back there, and that doesn't help. I'm popping up a screen by your feet. That'll let you watch the scenery."

Freedman took the pill and focused his attention on the screen. Nearly three miles went by before he said, "Thanks."

She made him wait even longer before saying, "You're welcome."

Two hours later, just over four out from Luna, Kaze had managed to crank them back up to around 23 MPH. She had her hands full keeping it there, and her arms were already starting to ache, but no one was going to accuse her of lollygagging.

"What are you doing up there, exactly?" Freedman said, breaking the silence which had reigned for the last hour. He'd spent most of that time working with his pad, and looking none to pleased at what it was telling him.

Kaze glanced up in the mirror. "Driving."

"I know that," he said with exaggerated patience. "What else are you doing besides telling this thing to go forward?"

"Mostly keeping the wheelie side down." She spoke a command into her mike, changing the display at his feet to show a view looking out over the back of the train. "See those red glowing spots popping on and off over the cars?"

"I see them."

"Those are pusher motors. This engine and each of the cars has them on top. They work by pumping dust into a containment chamber and blasting it with lasers. When they fire they exert downward force. There are also pusher motors on the sides, and even the bottoms of my engine and the cars."

Freedman frowned. "What for?"

"The enemy here is bounce. The top pushers help control that. The ones on the sides are to stabilize the cars during turns and when the roadbed tilts. The ones on the undercarriage are to help keep us from getting bogged down in deep dust or other loose stuff. They're powerful enough to let me make this thing levitate if need be. Not that I would try—no wheels on the ground and no going anywhere. The route we're following skirts the worst of the bad stuff. A more direct line to the Waterworks would take us over more difficult terrain."

Freedman absorbed that information. "Why not use a shorter route and those pushers more?"

"A couple reasons. First, crankier terrain means more chances for something to go wrong. Second, we'd burn a lot more juice. Energy to run the pushers comes from the same storage banks that run the drivers. The waypoints can pump in only so much power as we pass by. A higher energy draw trip would mean a lot more waypoints."

"And what are waypoints?"

"Fuelling stations. Small solar/fuel cell plants that charge up a battery bank. That bank in turn feeds a NAMPA."

"A what?"

"NAMPA. Narrow Aperture Microwave Power Antenna. It beams power at the train as it passes by. That's stored up and used on the next leg."

Freedman hook his head. "Sounds complicated."

She shrugged. "Not really. It's just the most efficient way to run a train on the Moon. We need the train."

"Do you, really?"

"Sure. It's the most economical way to haul water and ice to Luna now and in the future. If Luna is going to work, it needs water."

He mumbled something she didn't quite hear.

"What was that?" she said, trying to catch his eye in the mirror.

He stared back with an air of challenge. "I said, who really cares if Luna works?"

* * *

Kaze wasn't shocked or even particularly surprised by his attitude. There were a lot of people—besides the terrorists—who thought that the building of a lunar colony and a water system to supply it shouldn't be happening. Some condemned it as a waste of money and resources. Some were convinced it was a criminal boondoggle, existing only to line the pockets of those making a profit from the project. Some pushed the idea that it existed only to satisfy the peculiar urges of a motley group of dreamers, misfits, and space nuts who would be better off heavily medicated and kept away from sane people.

Political support was tepid at best, both inside and outside the UN, which had chartered the project. Fortunately, political opposition didn't run much hotter, mostly because the giant corporations which were involved carried enough clout to keep it that way. Worldwide apathy about anything other than fewer bombings, more channels and faster access, and lower bills and taxes meant no one much cared if they succeeded or failed.

Still, the project's visibility and UN sponsorship had served to make it a genuine target in some quarters. Like the old saying went, *You know you're a success when the terrorists come after you.*

Most of the actions Earth Only and similar groups had attempted so far had been relatively minor, more an annoyance than a real danger. Lee Chen had managed to keep them safe from almost everything bad the fanatics had sent their way.

Only Lee was dead now. Killed as part of a larger and nastier plan. According to Freedman a *sophisticated* plan. One stage of which was grounding everything that flew.

Kaze didn't rise to the bait and try to defend the project. If this boob couldn't see the value of what they were doing, then the problem was in his seeing and not their doing. Instead she decided to deal with a personal annoyance, namely not knowing what the hell was going on.

"So what is it you have to do at the Waterworks?"

"I told you before. That's classified."

"Give me a break, will you? Who am I going to tell?"

Freedman shook his head. "Just concentrate on driving. We *have* to get there faster than you're managing so far."

"Hey, do you want to try driving this thing?" she snapped.

"I'd prefer to try *arriving.*"

Slaw called to check in when they were about five hours out. Kaze took the call on her headset, glad to break up the boredom.

"*How are you doing out there?*" he asked.

"Just ducky," she grumbled. "Orgy starts any minute now."

"*Colonel Freedman isn't really a fun guy, is he?*" Slaw commiserated.

She glanced up. Her passenger was scowling at his pad again. Was he even smile capable? "Roger that."

"*Well, you're making great time, Kaze. You're way ahead of schedule.*"

She snorted. "That's not what I'm hearing."

"*I'm not surprised. This guy is in one heck of a hurry. Remember, he had enough pull that he was going to be allowed to commandeer the shuttle after it dropped off passengers, and take it straight to the Waterworks. The dosed fuel stopped that, and he went ballistic. When he found out your train was the only way left to get there we thought maybe he'd shoot someone.*"

"What's the big yank?"

"*We don't know, and no one will tell us anything. All we do know is that Freedman is one heck of a rush.*"

"I'm going as fast as I dare, Slaw. Any faster and we go sub-orbital."

"*I know that, kiddo. Just keep doing your best.*"

Time ground on as Kaze navigated them along the wandering track to the Waterworks. By the seven hour mark the computer was predicting arrival in another ten and a half hours. The strain of running at such speeds was wearing her down, and the fact that she'd spent half the twelve hours between her last run and this one drinking and turning Buddy every which way but loose was catching up with her.

But she was positive she could see it through. She prided herself on being tough, and maybe a little crazy. Being half everyone else's size didn't mean she was any weaker or less capable than anyone else. She'd proved that time and again before, and she'd prove it now.

This run would be one for the record books. She figured people would be talking about it for years to come.

She came up way short on that expectation.

The call that changed everything came in about twenty minutes later.

"What's up?" she answered.

"*Kaze, it's Robyn. Can you put Colonel Freedman on? It's an emergency.*" The site boss sounded freaked, which was a new one on Kaze. Robyn was usually so unflappable she made NASA pilots look like twitching wrecks.

"Sure. Give me a second." She could have toggled it over to the headset in back, but wanted to listen in and get some better idea what the hell was going on. So she switched to ambient, made sure the noise filters were on high, and cranked up the volume. Glancing up in the mirror she saw that Freedman had dozed off.

"Colonel!" she bellowed, hand over the mike. "Wake up! Call for you!"

His head came up off his chest. For just a moment he looked confused, then his expression quickly changed to fury. "You shouldn't have let me fall asleep," he snarled.

"Didn't know I was your mamma. I've got Robyn Hampton on the horn for you. Go ahead, Robyn."

Hampton's voice boomed out over the din inside the cab. "*Colonel Freedman?*"

"Here," he snapped.

"*We just received a message via our offices on Earth. It says, and I'm quoting here, that 'at 2400 hours GMT the Luna project will be expunged. There will be an explosion of massive and apocalyptic proportions at the so-called Ice Mine. The very Moon will tremble, bringing down the walls of the vile stinking Babylon the UN is constructing there so it can hold a gun to our heads from space.' It goes on like that a while longer, but that's the gist of it.*"

Kaze had been splitting her attention between the track ahead and Freedman's face. She saw it sag, then go hard again. She checked the road, then glanced at the clock.

It was 19:27 hours.

Freedman spoke again, his tone gone urgent. "Have there been any reports of unusual activities or events at the mine?"

"*We've been monitoring like you said. A few minutes ago one of the boreheads stopped responding to outside controls, melting itself deep into a vein of softee—that's a sort of water/gravel frozen slush. They haven't been able to figure out what's wrong with it or get it back up.*"

Kaze had looked up to watch Freedman. On hearing this his face went gray and he closed his eyes. His expression made her swallow hard. Whatever else this guy was, he didn't seem like the type who scared easily. This had to be bad. *Real* bad.

"*Has this got something to do with the warning, Colonel?*" Robyn continued.

"Yes," he answered with a grimace. "I want you to have all operations at the mine shut down immediately, and the area evacuated."

"*But there's nowhere for them to evacuate to!*" Robyn protested.

"Do what you can. Get them in hard suits and ground vehicles, and move them back as far as possible. Now."

"*What's going to happen? Is there a bomb?*"

He hesitated a moment, then said, "Yes."

"*How big? How bad will it be?*"

Freedman shook his head. "Very bad. Contact the Security Office up on Moth. Tell them what you told me, and that I think there's going to be a contained PTND ice blast. They'll advise you as to what procedures to follow."

"*But Colonel—*"

"Call them. Now." Freedman saw Kaze was watching. He made a cutting motion across this throat.

She toggled off ambient and spoke into her mike. "We've got to go off the air for a bit," she told Robyn. "Better do as he says. We'll get back to you as soon as we can." She cut the connection.

Kaze checked the route ahead, then looked up to see Freedman. He sat there with his head bowed, staring at the silver case between his feet. The defeated slump of his shoulders was obvious, even under the heavily padded 'ralls.

Kaze cleared her throat. "Now are you going to tell me what this is all about?"

No answer.

She raised her voice, her tone sharpening. "Look, the secret is out. There's a bomb at the Waterworks. So tell me the rest. What difference can it make?"

His head came up and he glared at her. "Not one damn bit," he rasped. "My chance to do anything ended when I climbed aboard this miserable piece of shit train."

Kaze let the slur pass, splitting her attention between driving and watching him. "Nothing else was running," she pointed out patiently.

He sighed and lifted his hands, then let them fall. "I know," he said wearily. "The failures were ours. Somehow they got a bomb past Chen, then they killed him when it looked like he was finding out about it after the fact. Same for the catalyzer contaminant. We brought real assets in too late, and we've been behind ever since. Now everybody dies."

"At the Waterworks, you mean."

He shook his head. "People will die at Luna, too. Maybe not all of them, but there will be casualties, and lots of them."

Kaze swallowed hard. "How big a bomb *is* this?"

"Not that big. It's the bomb's placement. That borehead acting up was no coincidence. We found information hinting that a borehead might be rigged, but not how. Now we know for sure. That's where the bomb is. The worst place possible."

"Because . . ."

"It's a PTND—a Pocket Thermonuclear Device. Compared to a full-scale nuclear weapon, it's just a firecracker. But when it goes off, all the ice in an immense sphere around it will be instantly transformed into superheated steam. Steam which will be confined by the surrounding ice and rock."

Kaze was getting the picture, and not much liking what it showed. Steam lore was a part of her family history. Boiler explosions were terrible things. This would be the mother of them all.

She remembered what Robyn had read: *The very Moon will tremble.* "Will the steam and shockwave put enough stress on the surrounding rock to cause a quake?"

"That's the assumption. Even if it doesn't, an instant volcano will be created. The materials ejected from the blast will cause severe damage to everything within at least 500 kilometers of ground zero. And the cloud of debris will remain a hazard for some time to come. Stir in radioactivity and you have the recipe for one hell of a disaster."

Kaze checked the clock again. 19:34 hours. Four hours and twenty six minutes until her world ended.

Unless it could still be stopped. She took a deep breath. "If I could get us there in time could you defuse this bomb?"

"Yes," he answered with a sigh. "You may think I'm a son of a bitch, but I get along with bombs just fine." He met her gaze in the mirror and managed a wan smile. "You did the best you could, Ms. Joad. I know that. No one else could have made this thing move any faster. But like you said, it's a train, not a rocket plane."

A nearly twenty-four hour run gives the mind lots of time to wander. Kaze had made dozens of round trips. That had been plenty of time to fantasize having sex with every interesting man she had ever met. To daydream of being a pro basketball player, and a model, and a pilot, and a hundred other things that being a dwarf had prevented her from doing.

More than enough time to have noodled up bizarre ways to make her slow old train go faster. Ways you would have to be stone crazy and flat out desperate to try. Talk about the bomb had given her an idea which might make one of them possible.

She began pulling back on the yoke. The whine of the engines changed as the train began to slow.

Freedman scowled at her. "What are you doing?"

"We've got to stop for a few minutes."

"Why?"

"I've got to go EVA and move some cargo around so we can go faster. A *lot* faster."

He stared at her uncertainly. "How?"

She grinned back at him. "That's classified, bunky. If I told you I'd just have to kill you."

Probably to keep you from stopping me from trying this.

Once the train had come to a halt Kaze grabbed her helmet and exited through the small nose lock. Once outside she did the things which needed to be done, working as fast as she could. Fifteen minutes later she locked back in again and crawled into her seat, puffing from exertion.

"What was that all about?" Freedman demanded when she took off her helmet and pushed her sweaty orange hair back. She'd left the monitor by his feet set so he could watch, but doubted it had told him much.

"Step one," she explained, locking the yoke back in place and starting Engine 1 rolling again. When it pulled away only one car remained in tow: the tanker which had been coupled directly behind the engine.

"Step one of *what?*"

She gave him a sweet smile as the train lumbered up past the 5 MPH mark.

"Step one of making this mother fly."

Luck was with them when it came to the section of track they were on. Not ten minutes after ditching the boxcars, Engine 1 came within range of the next waypoint. Kaze kept them on track for a while longer, soaking up power all the way, then began heading off at a slight angle to her normal route, following a path she'd plotted using the GPS, satellite imagery, and stored maps.

Freedman spent that time communicating with various experts up on Moth and back on Earth. Finally he sighed and stowed the pad in his pocket.

"They say what you're planning isn't possible," he informed her quietly. "They advise against it." A significant glance. "Actually they ordered us not to do it."

"Is that so?"

"Yes. They say we should wait for a flyer to be made usable. They say we'll only kill ourselves attempting your plan."

"What happens if we're sitting out here when that thing blows."

His voice was flat. "We die."

"Not a lot of reason not to try this then, is there?"

"That's what I'm thinking."

"We just passed out of charging range," Kaze called over her shoulder. "I'm at 98 percent energy reserves. Our runway could be better, but there's no time to go looking for another." She glanced up in the mirror. "You ready?"

Freedman gave her a solemn nod. "Ready as I'll ever be."

"Then hang on. The ride is about to get a tad bumpy." She pushed the yoke forward, increasing power to the drive wheels. They were already at 20 MPH. That number began to slowly tick upward. The cab was already shaking and shuddering. It got worse. Then it began to lean as she turned hard to the right.

The train, now consisting of Engine 1 and the tanker, headed off on a route sharply angled away from the one it usually followed. The original path skirted a two-hundred-meter crater on one side and a far larger one on the other.

The comm beeped. Kaze answered with a cheerful, "What's up?"

"*Kaze!*" Slaw yelled, sounding freaked. "*You're heading straight for a crater!*"

She nodded. "We sure as shit are."

"*Turn away!*"

"Can't, Slaw. Meant to call and tell you before, but I've been busy. We're taking an alternate route to the Waterworks."

"*How?*" he wailed.

She chuckled. "Straight up, honey."

"I . . . thought . . . you said . . . this would . . . get bumpy!" Will Freedman bellowed, forcing the words out between impacts of his back with the thinly padded wall behind him, and trying to make himself heard over the mechanical pandemonium inside the cab. The engines howled and the drive wheels rumbled. The speed readout had reached 29.6, and it sounded and felt like the train was about to shake apart around them.

"It will!" she shouted back. "You got . . . the controller ready?"

"Ready!"

"Almost time. . . ." Okay, she'd jumped a dune buggy or two back on Earth. Taken a few flying lessons. This shouldn't be that different, right?

I must be out of my frigging mind, she though with grim hilarity, then threw back her head and screamed, "Fire the first charge!"

Freedman jammed his gloved thumb on big red stud of the device in his hands, then quickly reset it for the next command.

Back inside the tanker a popper ignited. Poppers were used both at Luna and the Waterworks. They were small, remote-controlled incendiary devices used to burn holes in solid rock. There had been crates full of them in one of the boxcars.

The water around the popper began to boil, turning it into steam.

"Starting to see some pressure," Kaze reported, keeping half an eye on the telemetry from the tanker. "Fire two more!"

"Firing!"

Kaze nodded to herself as the pressure reading started to climb faster, pushing up toward the mark the ceramic tank was rated to withstand. Ground speed was up to 32 MPH, overheat warnings from the Clydesdales and the pumps flashing.

"Come . . . on . . . baby . . ." she pleaded, the yoke pushed to its stop. They were definitely traveling uphill now, and she could see the lip of the crater in the distance. Power reserves fell steadily, the engines sucking up current and the pusher motors firing nearly continuously to keep them from bouncing up or flipping over.

33 MPH, the shuddering cab filled with a hot electrical smell. It was now or never.

"Fire the rest!" she screamed.

Freedman never hesitated, touching off the other twelve poppers she'd put in the tanker.

The tank's rear main valve had been slaved to a control on her yoke. Kaze split her attention between driving the all but out of control train and watching her displays. Instinct told her when the tanker was about to blow, and she acted on it.

With one stubby thumb she triggered the valve's release. With the other she squeezed the emergency decoupler, allowing Engine 1's drive wheels to spin freely.

There was a half-second hitch, then sudden acceleration shoved her back in her seat.

The blast of steam blew out of the valve at the bottom rear of the tank like exhaust from a rocket, the vapor turning to snow and ice crystals behind them. Powered by this unconventional engine, the train surged ahead, big basketwork wheels spinning into a blur. One tanker wheel clipped a boulder and disintegrated, exploding into a thousand pieces. Then a wheel on the opposite side came apart. Two more started to wobble.

But by then it didn't matter. She'd cut the top and side pushers, throwing everything she had to the ones on the underside of the train. The train went faster yet, wheels coming up off the ground, and blasted toward the lip of the crater. Beyond was a two hundred meter drop.

Riding a sparkling exhaust of snow and ice, and fire blasting from its belly, the train drove on out into the abyss.

The horrendous shaking stopped, and after a moment acceleration fell away. Kaze laughed aloud as a feeling of weightlessness swept over her. "Hot *damn!*" she crowed. "We *did* it!"

Will Freedman was laughing too. "I don't *believe* it! You launched this damn train like a *rocket!*"

"*We* did it, honey! Me as engineer and you as fireman! Holy shit what a rush!"

Still shaking his head in grinning amazement, Freedman said, "How fast are we going?"

Kaze peered at the display. It read 0. "Uh, that's going to take a bit of figuring. I can tell you that we were doing over 65 when the wheels left the ground." She swung the navigation board in close, slaved it to his screen, then started a GPS query. After several seconds to take a series of positions, the answer came back.

"Eighty-six miles per hour," she announced.

"I hate to be fussy, but how long to the Waterworks?"

"Um, let me see." That took a bit more figuring. "We left the ground at about 150 miles away as the train flies. So figure a bit under two hours."

Freedman let out a sigh of relief. "That's time enough."

"I hope so. Now don't forget, we will lose some time slowing down to land."

Their eyes met in the mirror. "Do you have any idea how you're going to land this thing?" he asked quietly.

Kaze shrugged. "I have a rough idea."

"For a rough landing."

"Probably," she admitted.

"So what now?"

"I call Slaw back and have him put together a mission control for us. As of now we need one."

A state of emergency had been declared at the construction site. All personnel had been directed to take refuge in the biggest of the domes they'd built so far. It was hoped that the tough clear ceramic panels roofing it over would stop the worst of the debris. The space had already been pressurized, but everyone was in their hard suit and ready to helmet up at a moment's notice. Being the kind of people they were, most of them found some sort of work to pass the time, rather than just stand around waiting to die.

Slaw had stayed in his office, tracking Engine 1 every kilometer of the way. He'd called Robyn Hampton and Dave Broadbent back in as soon as he saw the train take off—and when he could speak coherently again. When Kaze called they were ready to provide what help they could.

Back in the cab, Freedman had left his cramped jumpseat and crouched behind the engineer's chair, looking over Kaze's shoulder as she worked with the people back on Luna, trying to get the train lined up properly and on a path which offered some chance of bringing it down for a safe landing.

Kaze's aim had been pretty good, considering; she was only a couple degrees off from a straight line to the Waterworks. Dave was able to help her figure out how much to fire the side-mounted pushers to get better lined up.

More of a problem was the speed and angle they had taken off at, and the amount of time she'd left her underthrusters at full power. That had set them on a trajectory which would have them overshooting by some fifty kilometers. Still, that was better than falling short of what Dave kept calling their objective and Kaze blithely referred to as their target. A coordinated series of bursts from their top pushers bent their curve into something flatter and shorter.

All this took time. Once those issues had been dealt with the one big question remained: how to land the damn thing.

"*Listen to me, love,*" Dave repeated patiently, staring out of the screen at Kaze with his best no-nonsense face on. "*You have to begin braking now.*"

"Which will begin slowing us down."

"*That's the whole bloody point of braking!*"

"But the more I brake the longer the trip takes."

"*Well sure, but—*"

Kaze twisted around to stare up at Freedman. "What do you say? Do we play it safe or go balls-out?"

He stared back down at her expressionlessly. "You know what you can do. I don't."

"But the more time you have, the better your chances of defusing the bomb, right?"

A solemn nod.

Kaze faced Broadbent's image again. "How fast do you want me coming in?"

Being a pilot, he told her in meters per second.

She did the math in her head, frowned. "Twenty miles per hour?"

He blinked, converting that back to metric. "*Yeah, just about. You can* *manage that if you start now. I'd rather have you coming in even more slowly, but that's the best solution considering those pushers you're using.*"

"Screw that. I figure I can cope with coming in at fifty or so, as long as I come in fairly flat and—"

Broadbent never let her finish. "*Are you out of your bloody mind, woman? You'll never walk away from the wreckage if you come in that hot!*"

Kaze stuck her chin out. "Hey, Dave, I got this mother off the ground, didn't I? I can set the son of a bitch back down again!"

Broadbent's gaze lifted and he appealed to Freedman. "*Colonel, can you talk sense to her? Get her to dial back the craziness a bit?*"

The security man stared back a long moment, his dark face inscrutable. Then he rested a hand on Kaze's shoulder.

"The lady is driving," he said.

"You comfortable?"

Freedman let out a glum chuckle. "Not particularly."

"Me either. Not only are you a hard-ass, Colonel, your lap isn't much softer. Not to mention the lumpy bits."

It was a foregone conclusion that their landing would be some crunchy flavor of crash. It remained to be seen how crunchy.

The jumpseat was too small and badly padded to offer much in the way of protection. Since the shock-mounted engineer's seat was the best place to ride out a crash, Kaze had insisted that they share.

Now as the final minutes of their improbable flight ticked away he was ensconced in the seat with her sitting on his lap, the safety harness covering both of them. The engine's controls had been reconfigured to put them within easy reach for her from this new perch.

The last set of corrections had been carried out. Kaze had drawn them each a coffee. She savored hers as she sipped, refusing to let herself dwell on the fact it might be her last. It would have been nice if it had been better coffee.

"So," she said to break the silence which had sprung up after her mention of the lumpy bits in his lap. "Bet you never thought you'd strap on a dwarf chick."

She felt him wince. "No," he said, shifting uneasily under her. "I don't suppose I did." He hesitated a few seconds. When he spoke again his voice was lower and softer. "I owe you an apology, Ms. Joad. I made unfair judgments about you based on your, ah . . ."

"Condition?" she supplied. "The fact that the top of my head is about even with your navel?"

"Yes," he admitted softly. "And I'm sorry. I never met anyone like you before."

"If you're talking about me being a dwarf, there aren't as many of us as there used to be. They fix that in utero most times these days." She squirmed around a bit. "Now if you're talking about me being such a hot number, well, you know what they say: Once you go dwarf you can never get enorf."

Freedman chuckled dryly. "They say that?"

"After they've been with me they do."

"I can believe that." His tone turned serious again. "How come your family didn't, ah, do something?"

"Like fix me?" She laughed and shook her head. "My family is kind of unusual. My father and mother met when he was driving a train for the circus. My condition seems to crop up on his side of the family fairly often, and it was always the small fruit on his family tree that went the furthest. My mother's side of the family are all circus people. Nobody saw anything wrong with me being this way."

"And you're okay with it?"

She shrugged. "It's kept me from doing some things, allowed me to do others. I used it to my advantage when I went for this job, yelling discrimination whenever I had to." She snorted. "Not that there was a lot of competition for a glamour job like this. Only someone from a family like mine would bust their ass to get twenty-four hour shifts running a train on the Moon."

"I'm glad you got the job." A hand patted her shoulder. "I really do think you can pull this off. If only by force of will."

Kaze tossed back the dregs of her coffee. Put the cup aside and took hold of the yoke.

"You keep that thought," she said. "Coffee break is over. The little train that could is about to come in for a landing."

Dave had helped Kaze set the train up to come in at the shallowest angle possible. His image was on one of her screens, and he supplied a steady stream of advice and information derived from satellite imagery and GPS tracking.

"*You altitude is sixty-five meters. You're going too fast and dropping too quickly, Kaze,*" he reported, a faint edge of worry worming its way into the bland tone he had managed so far. Any sort of flying craft would have had an altimeter and some means of measuring rate of descent. No one had ever though such things would be needed on a train.

"Pushers are going full out," she answered tersely. The rate the ground was coming at them was seriously unnerving.

"*I'm afraid your cabin will come apart if you hit this hot. Fifty two meters.*"

Kaze was more worried about the wheels coming off. If only she could flare out like a landing aircraft. Or deploy a drogue chute . . .

Then something clicked. Her eyes widened. "I got an idea!"

"*What?*" Dave demanded.

"Do it," Freedman said quietly behind her. He had his arms wrapped around her to help brace for impact. Now he gave her an encouraging squeeze.

Her small hands flew across the yoke's control pads, turning off one set of pushers, energizing another.

"*Kaze!*" Dave bellowed. "*What the bloody hell are you doing? I'm seeing the pushers atop your tow firing! You're losing braking! Are you nuts?*"

She chuckled. "Honey, we're about to find out."

The flying train rushed closer and closer to the hard, unforgiving lunar surface. The crimson pusher burn from the underside of the tanker car stopped, the pushers atop it pulsing to life at the same moment.

The train had been coming in nearly level. Now it began a sort of slow vertical jackknife, the back end of the tanker swinging ponderously down and the front of the engine rising slightly.

In a race to meet, the train and its shadow came closer and closer to merging. Ten meters. Five meters. One meter.

The rear end of the tanker struck in a tremendous burst of dust and stone chips. It tried to bounce, but inertia and the pusher motors held it down. The end of the tank began breaking up, ground away like a salami against a grater. Shock transmitted up through the coupling made Engine 1 shiver and jerk, pushers popping from one side to the other to keep it lined up. The tanker wheels which had survived takeoff crumbled, spinning away in fragments.

Half the tank's length was on the ground, then three quarters, throwing up a wake of debris and pieces of itself as it was dragged along—

—acting as a drogue and slowing the train down ever so slightly.

Then with a massive geyser of dust and gravel that blotted the train from sight, Engine 1 touched down.

Kaze and Freedman were thrown violently against the wide straps of the harness. Kaze felt something give in her chest as all the big man's weight slammed into her from behind. She would have screamed, but all the air had been driven out of her lungs.

That and the shock of touchdown nearly yanked the yoke out of her small hands. She held on grimly, fighting to control the engine and what remained of the tanker. Warning lights exploded across her boards as load and stress limits for the driver wheels were passed, doubled, tripled. The speed indicator went from 0 to 54 MPH in an instant.

"*Brake!*" Dave bellowed at her from a screen that was being shaken so badly his image had gone fuzzy.

First instinct was to obey and haul the yoke back. But she knew her train, and the peculiarities of lunar ground travel. Even if they didn't skip—which was going to happen anyway—that would probably snatch the wheels right out from under them.

So she jammed the yoke forward to its stop, cycling the unloaded Clydesdales up with a yowl of protest, and when she thought she had every RPM they could deliver to the pumps, recoupled the wheels.

The locomotive and the shredded remains of the tanker bounced, multiple tons rising up out of the cloud it was creating, top pushers firing full out and wheels churning at nothing. As it rose it tipped slightly to one side, pusher motors along that side igniting, fighting to level it up. Down it went again, hitting off-balance and hard enough to compress the driver wheels along that side by half a meter.

It skidded precariously on one side for three agonizing seconds, then dropped back down on all wheels hard enough to make it try to bounce again.

On it slid toward the distant Waterworks in a blazing red cloud, like it had driven up out of Hell and was coming to deliver the devil.

The only thing inside the cab not flashing a warning was the coffeemaker.

Kaze could feel the driver wheels catch and then lose purchase, each bit of traction shoving her against the straps. She could smell her engines frying, and smoke had started filling the cab.

That was easy enough to ignore. The whistle of multiple vacuum leaks from sprung seams in the cab would keep the smoke from getting too thick.

Freedman heard them too. "*We're losing air!*" he bellowed right next to her ear, the tight grip he had on her battered chest making it even harder to breathe.

"Not . . . a problem!" she gasped, struggling with the yoke.

"But—" he began, then the emergency helmets in their 'ralls activated, set off by the drop in cab pressure. The tightly rolled plastic tubes inside the necks of their 'ralls unfurled, rising up around their heads and closing in above them.

Kaze barely noticed, a fierce grin coming onto her face as she felt the speed of her wheels finally begin matching that of the ground under them. She began gingerly feathering the yoke back to begin braking. The drivers skidded, took hold, skidded, took hold. Their speed began to drop. 52 . . . 51 . . . 50 . . .

There was still enough air left in the cab to let her hear the alarm which sounded when one of the Clydesdales caught on fire. Her gaze flicked to the diagnostic board, taking in the situation.

"Grab the yoke!" she shouted.

Instantly Freedman's big gloved hands were on it beside hers. She let go and twisted off to one side, a deep stabbing pain filling her chest and black motes dancing before her eyes as she reached for the fire suppression override. Gritting her teeth and blinking against the haze which filled her vision, she slapped the override.

"What are you doing?" Freedman hollered, helmet against hers.

"Foam'll fuck up my engines!" She uncovered a big safetied switch, tripped it. An emergency hatch in the engine compartment blew, flooding it with vacuum.

"*KAZE!*" Freedman shouted. The cab lurched crazily and began to cant dangerously to one side.

She got facing forward again. They were heading straight for a storage building in the perimeter of the Waterworks.

Freedman had tried to take evasive action, wildly over-steering. She took the yoke back and got them on the ground again.

Was there enough room to turn without flipping over? Doubtful.

But there was one surefire way to stop.

Hit something.

The train headed straight for the shed, half its length hidden in a roiling, red-lit cloud of dust. Their speed continued to drop, but they were still doing over thirty as they came up on the shed.

Kaze would have yelled *Hang on,* but she didn't have the breath to spare, Freedman's arms were wrapped around her so tightly. All she could do was hold on and keep braking.

The train slammed into the building. It came apart as if dynamited, spools of cable and crates of equipment and flindered foamstone panels flying in every direction.

Engine 1 went all the way through the shed and stopped with a jerk halfway through a second building, hidden behind the first. It vanished in a wall of dust and debris, still firing thrusters making it look like was inside a huge fireball.

"*Kaze!*" Will Freedman gasped as he fumbled blindly for the clasp of the harness. "Answer me!" He had the soft double-walled plastic bubble of his 'rall emergency helmet pressed against hers so she could hear him and he could hear her.

No answer.

When they hit the first building the impact had slammed them against the restraints again, this time hard enough to have driven the air out of his lungs. She, being in front of him, had borne the brunt of the force. For all he knew he'd killed her.

The clasp released. He shucked the straps off them, then lifted her up and turned her around. She hung in his big hands, small as a child. Her eyes were closed and there was blood at her mouth and nose. But it bubbled. She was still breathing.

He gently lowered her back to his lap and looked around helplessly. There was a big red slap-switch marked EMERGENCY SYSTEMS SHUTDOWN flashing for his attention. He banged it with his fist.

The boards stayed lit, but the vibration from the still-running pushers died away. He looked up into the mirror to check on his tool-case. It was still securely belted into the jumpseat.

A glance at the clock. Fifty-four minutes left until zero hour. He had to get a move on.

His attention returned to the small unconscious woman on his lap. Taking her along would only slow him down. The smart thing to do was leave her there.

Cradling her carefully against his broad chest, he worked his way over the seat and into the back of the cab. Retrieved his case, and still carrying her, squeezed into the side access hatch niche. The hatch was stuck, but a kick drove it open.

A minute later he was bounding across the ground toward the Waterworks, racing against time.

"*—ze! Wake up!*"

Kaze's eyes opened. She groaned and closed them again.

Freedman leaned closer. The minehead was under pressure, so the emergency helmets in their 'ralls had deflated. He stroked her forehead. "I need you to help me, Train Lady."

Her eyes opened again. "What?" she rasped, then coughed, the spasm racking her small frame. "Oh, shit, that hurts."

"I know," he replied gently. "I think you've got a couple broken ribs." What he didn't say was that the bubbling undertone to her breathing suggested a punctured lung.

She turned her head and spat. What came up was bright red. "I'm too beat . . . to drive you back," she said, turning to face him again.

Freedman sat back on his haunches, but kept a hand on her shoulder. "I bet you are. I've got a problem. The bomb can be stopped if I can get an EMPlary device close enough to it that its triggering renders the bomb inert."

"What's an EMPlary?"

"This." He showed her something that looked like a big steel cold capsule as big around as her wrist. "It produces a powerful electromagnetic pulse when it goes off."

"Okay . . ."

"The only way to get it down to where the bomb is located is to put it in the primary output line from the borehead. It should be heavy enough to sink down through the slush to the borehead."

She nodded in understanding. "But you can't get it in."

"No. The only direct, straight-down access to that line is through the swingarm end. There's an inspection panel in the side."

Kaze grinned crookedly. "Let me guess. You're . . . too friggin' big . . . to reach far enough inside."

"Yes. And there's not enough time left to locate a crew member small enough and get them back here."

"So I'm it?"

"I'm afraid so. Think you can do it?"

She grimaced as she tried to sit up. "Only one way . . . to find out."

Freedman carried Kaze out the spidery catwalk that ran along the swingarm gantry. The panel was already off, the opening at about chest level for him. He helped her crawl inside. The space was too tight for real access. Even with arms and legs as short as hers it was a close fit.

She dragged herself into the guts of the big machine, a flashlight in one hand and the EMPlary in the other. Every fraction of a meter was gained at the cost of stabbing pains in her chest. She kept having to spit out thick gobs of blood and phlegm.

"You should be almost there," Freedman called, his voice ringing hollowly. "Look for a really big pipe tee."

"I see it."

"See the flexible corrugated pipe coming out the top? According to the blueprints that's an air line."

"Yeah. It's got . . . a Woolson clamp . . . holding it on?"

Freedman consulted his pad. "Yeah, that's it. You need to unclamp that airline and put in the device. Gravity will do the rest."

"Getting to . . . where I can reach it."

"Once you've placed the package we can get you the hell out of there and to see a medic."

"*That* . . . sounds good."

All Freedman could do was wait and worry. He could hear muted clunking noises and muffled curses coming from inside. And panting, like her breath was growing shorter all the time.

He knew he should never have sent her in there. But there had been no other option. Other help was too far away, and it would have taken him too long to disassemble the swingarm covers to the point where he could reach the spot where the EMPlary had to be injected.

Now it was beginning to look like this might not work either. There were only five and a half minutes until the bomb was supposed to explode. According to the experts up on Moth it would take five minutes for the EMPlary defusor to sink deep enough to be in optimum range.

"*Clamps are . . . stuck . . . won't release—*" she called hoarsely, sounding near tears.

"Just take your time, Kaze," he called back, knowing time was the one thing they didn't have.

"*Trying . . . again—*" A groan.

He leaned against the side of the housing. They had both tried. Her especially. She'd shown more heart—and balls—than any man five times her size.

His pad beeped as the five minute cutoff came and went. Even if she got the package placed in the next few seconds the odds of it being effective had already begun to drop.

"*Got the . . . clamp!*" Several panted breaths. "*Now let me get . . . damn . . . connector off—*"

Four minutes and twenty seconds.

More thumping and breathless cursing.

Why was this happening? Because his agency hadn't taken protecting the work on the Moon seriously enough, assigning only one man to the task. And why was that? Because they hadn't taken the project seriously. He sure hadn't.

Maybe it wasn't necessary. Maybe it was eating resources which could be used elsewhere. But by God these people were showing more dedication to what they were doing than most everyone back on Earth.

"*I got . . . the pipe off! Now let me . . .There! It's in!*"

Three minutes left.

"That's good, Kaze."

"*Did we . . . get it in time?*"

He could have lied, but she had earned the truth.

"I doubt it. Not enough time for it to sink low enough to be effective."

"*Shit!*"

He tried to smile. "We gave it one hell of a try, anyway."

A bout of coughing, then a gasping laugh. "*You should be glad . . . I've slept with . . . a couple miners.*" More coughing. "*I'm gonna put . . . air line back. You go . . . to the board . . . this bore-rig. Turn it on. Hit . . . menu . . . for . . . troubleshoot. Then hit—*" the rest was lost to coughing. Even out there he could hear the sound of fluid in her lungs.

"Hit what, Kaze?" he coaxed.

"*Hit . . . purge.*"

Freedman bolted back along the gantry catwalk to the rig's controller board. It had been shut down, as per his order. There was just over a minute left when the board came back to active status. He stabbed his fingers at the screen, hitting the TROUBLESHOOTING menu. A list of options appeared.

Then he saw it, a blue tab marked AIR PURGE. He jammed his finger against it.

Somewhere inside the gantry a compressor kicked in and began pumping pressurized air into the water line, forcing everything in its path back down toward the borehead. Including the EMPlar.

A colored bar showed the progress of the purge. Eyes on the meter and the clock, he prepared to trigger the device.

There were fifteen seconds left when the purge level reached 60 percent. Ten seconds left when it reached 70 percent.

There were five seconds left when he triggered the EMPlar.

The next four seconds were the longest of his life.

But his life went on after they ended.

The Waterworks' infirmary was small, but the examination table was full size. Kaze didn't take up that much of it. There was plenty of room left over at one end for Will Freedman.

He sat there with his head bowed, a cup of tepid coffee held in hands which were still grimy from tearing apart the whole end of the swingarm. That had been the only way to get Kaze back out again. She hadn't been able to reset the clamps which had given her such trouble before, so to hold the air line in place she had wedged her body between it and the channel it ran through. Returning site personnel had helped him tear the machine apart, get her out, and carry her to medical help.

Freedman was so lost in thought that he didn't even look up when site boss Karel Gottsman stepped inside the infirmary. A man and woman in white medic's coveralls filled the doorway behind them, a stretcher standing on end between them.

"Colonel Freedman?" Gottsman said.

He lifted his head, blinked. "Yes?"

"They got the fuel problem straightened out up on Moth and have fliers running again. Two just came down. One's here to Medivac Kaze back to Luna. The other brought in a team to retrieve and remove the bomb. You're supposed to ride it back up to Moth for debriefing."

Freedman shook his head. "I'm going back to Luna with Kaze."

"But Colonel—"

"She got me here in one piece." He slid down off the table and waved the medics on in. "I intend to make sure she gets home the same way."

Kaze's eyes opened wide in momentary panic, then sagged shut when she saw Freedman. "So we made it in time," she said. Her voice was hoarser than normal, but her lungs were clear. The final tally had been four broken ribs, quite a bit of internal bruising, and one lung that had been punctured in two places.

"We made it in time," he agreed.

She opened her eyes again and looked around, wincing as she moved. "Where are we?"

"Infirmary back at Luna."

"Bet I'm a real mess."

"Oh, just a small one."

That made her smile. "Cute. So tell me, how bad did I trash my train?"

Freedman shook his head, his expression solemn. "It will never run again. I understand it's being taken back to Earth."

She sighed. "So I put myself out of a job?"

"Maybe for a while. But I'm sure you'll find something to keep you busy until Engine 2 arrives."

"Like what?" A challenging look. "You staying to keep my bed warm and keep me occupied?"

"I'm already in a relationship." He straightened up, smiled. "Now you get better. I'll see you again somewhere down the line."

She waved him away. "Yeah, that's what they all say. You take them for a ride and then never see them again."

* * *

Just as Freedman predicted, Kaze was extremely busy in the weeks which followed.

Slaw had methodically recorded the satellite imagery of Engine 1's race against the clock, and the way it had managed to beat it. Robyn had put it out for the media while Kaze was still being brought back home.

For once, news from the Moon wasn't being ignored. Kaze, who the media had begun calling *The Little Loco Lady of Luna*, was famous, her feat eventually earning her a place in human folklore as the train engineer who had outdone Casey Jones.

Sending Engine 1 and what remained of the tanker back to Earth was hideously expensive, but worth every penny. Once there it was taken on tour, drawing huge crowds wherever it went. The Luna project, which had looked so dull and unnecessary, suddenly acquired a new gloss and popularity. It was a place where heroes worked, and one small hero had made a train fly to save a new world in the building.

The arrival of Engine 2 was a media event, as was its maiden trip to the Waterworks. Every available passenger car was used, and all were jammed with dignitaries, celebrities, and of course media.

There was a camera mounted inside the cab of Engine 2, letting the world watch as the Little Loco Lady eased the yoke forward and started her new train rolling.

That camera didn't show her deadhead passenger, crammed into the tiny jumpseat back by the firewall.

But it did show her consulting a big shiny pocket-watch before heading out. One given to her by her unseen passenger in private before the trip began.

A big silver railroad watch with the phrase *Always On Time* graven on one side, and an image etched into the other.

A picture of an old-fashioned steam locomotive.

This iron horse had wings, and it was flying high above the Moon. ■

WEAPON OF MASS DISTRACTION

Richard A. Lovett

Can there be too much of a good thing?

Herbert Dappelmeyer was the first victim.

"I'm sorry, Mr. Dappelmeyer, but I can't sell you a ticket for that train," the clerk said. Her demeanor was normal but her knees were trembling so much it took two tries to find the toe switch for the silent alarm. Her name was Ginny and in six months on the job, she'd never before been afraid of a customer. But then Herbert was her first Red.

Herbert didn't notice. Not that this was surprising. He never noticed much of anything that wasn't going on inside his own head. "That's okay," he said. "I'm in no hurry." He'd been mentally rehearsing a lecture he'd be giving in a few days, about the evolutionary biology of desert wildflowers, and he really didn't care whether he continued the process on the train or waiting in the station. "Can you find me a seat on the next one?" He paused. Something else she'd said had finally filtered through the game theory of desert ephemerals. "Do I know you?"

In any other context, Ginny would have laughed and given one of a dozen ready responses to Herbert's accidental use of this, the oldest pickup line in the book. But with her ticketing screen flashing his name at her in big red letters, footnoted with urgent advice to call Security *immediately*, it was all she could do to keep from panic. *This man's a terrorist*, she thought. *He'd kill me as easily as he'd swat a fly*. Actually, Herbert was a gentle soul who was nearly as fascinated by insects as by plants, but Ginny didn't know this, and the blinking letters on her screen could hardly have been more frightening.

Ginny chose to ignore Herbert's second question and answer the first, although in her near panic she forgot even to go through the motions of checking the schedule. "Sorry, that's full too."

Calling him by name had been a serious error. Herbert had proffered cash for the $49 fare, and she'd not yet asked for identification. The only reason she knew his name was that the fast-optics scanners had picked up his fingerprints as he passed the bills across the counter. According to the technician who'd installed them, these scanners and their on-line database could identify virtually anyone from a ten-millisecond snapshot of a single finger. When the scan worked, there really wasn't much need to check IDs, although Ginny had heard of a terrorist who'd been caught because he used a fake ID that didn't match his fingerprints. Normally, though, Ginny viewed the scan simply as a way to improve her customer service. Most people loved being greeted by name—but then most people were law-abiding citizens. Very few were Reds.

Herbert shrugged. "Is there another train after that?"

Ginny shook her head, afraid of making a second mistake and angering this dangerous man who looked for all the world like a fuddy-duddy professor. "Sorry." The goal of terrorists, she knew, was to blend in. For years they might act like perfectly ordinary citizens, then their bosses would order them to kill and they would obey, in the name of fascism, or neo-communism, or God, or generic anti-Westernism, or any of a gazillion other -isms Ginny could only vaguely list. But the government was finally getting a handle on the problem, and Ginny was on the front lines of the latest battle.

Even the most covert terrorists had to buy food, clothes, gasoline, and countless other items—including train tickets. All of that could be tracked. Statisticians could study known terrorists' spending habits, searching for patterns, and these could be used to determine the probability that any given ticket purchaser might also be a terrorist. Ginny had the fortune, good or bad depending on how you looked at it, of encountering the station's first Red since the new profiling system had gone on line. If she survived, she'd be a hero. At the moment, she merely felt scared.

Herbert sighed. "Okay," he said. "I guess I can go tomorrow." He shoved the money back toward her. "Give me a ticket on the first available train."

That was the one thing Ginny couldn't do. If she did, he'd simply take it and walk away. On this subject, her training had been explicit. *Keep him talking until Security arrives*: that was the ground rule. But *where* was Security?

There was nothing to do but stall. "Advance sales require a credit card," she said primly. They didn't, but who was he to know?

Herbert was beginning to lose patience. "*Fine*," he said, opening his wallet. He stuffed the cash back inside, pulled out a bankcard and slapped it down on the counter. "Now give me the damn ticket."

Still no sign of Security.

Ginny knew what would happen next. The card would be denied and she'd have to explain that to an increasingly hostile man who at any moment would begin to realize he'd been caught.

"I'm sorry, that's against the rules," Ginny blurted, hunting for any diversion she could think of. She was simply no good at this cloak-and-dagger stuff. Her job was to help people make the connections they needed if they were Greens, or cautiously hand-hold them through the delays if they were Yellows or Oranges. Being obstructionist was alien to her. She extemporized as best she could. "That's a debit card, not a credit card."

Herbert had bought many train tickets in his life—airports were a hassle for short trips and he hated to drive—but he'd never before encountered such a requirement. "So?"

Ginny had no time for thought. She plunged ahead, inventing wildly. "A debit card is too much like cash," she said. "I need a credit card instead." The moment the words crossed her lips, she realized how inane they were, but now she was stuck with them, even though she could see outrage creeping across

Herbert's face. "I don't write the rules. I just follow them."

Herbert could be endlessly patient with wildflowers, but when it came to people, he had little tolerance for fools. His face reddened, moisture beaded his upper lip, and more sweat speckled his bald pate. He leaned toward her, across the counter. "Have you ever heard of Mark Twain?" he demanded.

Ginny resisted the impulse to flee, although she couldn't avoid pulling back involuntarily. Her voice was a squeak that even she could barely hear. "Yes . . ."

"Twain," Herbert said, peppering her face with "t"-spittle, "had a term for people like you. He called you 'insect authority.'" Herbert stabbed a finger in her direction, leaning even farther forward. "You latch onto stupid little rules and treat them"—more spittle—"like the revealed word of God. No wonder—"

Ginny was spared the rest of Herbert's tirade by the arrival of Security. First on the scene was Ramon Juancarlos, who'd been in the men's room when Ginny's page caught him at the most inconvenient possible moment. He instantly spotted the Red terrorist leaning toward Ginny, pointing something at her that looked like a gun.

Ramon knew his duty. So what if Herbert was a short, paunchy 50-year-old. He was a threat to the train, he was a threat to national security, and more importantly, he was a threat to Ginny, who Ramon deeply wanted to impress. He hit Herbert in a flying tackle that would have done a linebacker proud, and the two tumbled to the marble floor, with Herbert underneath.

Herbert woke in the Security office with a pounding headache, bruised ribs, and a muddled memory of an infuriating woman who refused to sell him a ticket. He'd forgotten most of his wildflower speech, but that was the least of his worries because he was surrounded by security guards and police officers who seemed to think he was a terrorist. His hands were cuffed, and for the longest time, nobody cared much about his sore head and ribs.

Herbert never understood all the details of what had happened to him. In jail, the detectives politely told him the obvious: the computer had profiled him as a high-probability terrorist. Then he'd compounded his problems by getting angry at the ticket agent who was trying to detain him. "You're lucky you didn't get yourself shot," one of the detectives said, although Herbert's attorney suspected this was merely bluster, intended to fend off a lawsuit.

Even the lawyer had trouble finding out precisely *what* profile had tagged a botany professor as a terrorist. "I could only get part of the story," he said when Herbert was finally released. "The rest is classified." The lawyer went on to explain that Herbert subscribed to several obscure foreign journals, and that the computer mistakenly viewed his subscription fees as credit transfers to other countries. "They're fixing that problem," the lawyer added. "So at least you've helped a few other scientists."

Herbert had also made overseas trips to places like Morocco, Syria, Mongolia, Tajikistan, Chad, and the Sudan. "Yes, I know that's because of your interest in deserts," his attorney said, waving off Herbert's spluttered protests. "And many of those countries have nothing to do with terrorism. But they're *adjacent* to potential terrorist states, and *that* caught the computer's attention. It also seems that precious few people other than you have visited *all* of those countries—something that was apparently a big deal to the computer."

Beyond this, the lawyer said, it was only speculation, although it was common knowledge that the core of the new program was its instant access to bank records and credit card transactions. "You made two obvious mistakes," the attorney said, "The first was a truly unfortunate decision to pay cash for a one-way ticket. That alone would almost certainly have drawn suspicion. Then, you paid off all of your bills before leaving town. Yes, I know they were due, but combined with the one-way ticket, it *looked* suspicious as Hell.

"I suspect, though, that the real trigger was a subtle combination of this with prior transactions—things like not running out to buy a survival kit when everyone else was, or spending too much or too little of your income on food, clothes, or travel. Maybe you didn't rent enough movies from Blockbuster. Heaven only knows. The point is that however innocent your activities were individually, the computer saw something suspicious in the *pattern*."

Herbert nodded sagely, but his attorney feared that the biologist would always have trouble with profiles. The man was a genuine eccentric in an era in which oddness would increasingly come under scrutiny. *Keep your head down, Herbert*, the attorney thought, as he bid his client farewell. But he didn't say it. Herbert's salvation lay in the fact that he was so blatantly eccentric that it didn't take a genius to realize he was a profiling error. It would help, though, if the man could learn to keep his temper under better control.

Angela Lamonte was the ten-thousandth victim. She was shopping at Robyn Macon's A-to-Z Bookstore, and had just reached the counter with an armload of books.

Robyn herself was manning the till. "How's the novel coming along?" she asked.

Angela and Robyn had been friends through the better part of two decades, and Angela's novel had been a work in progress for at least half that time. If it was ever completed (an open question) it would be an alternate history, set in mainland China during World War II. Angela had never been to China, but her grandfather had been one of the pilots who ferried supplies over the "hump" from India to the beleaguered Chinese army, and as a young girl, she'd been fascinated by his stories. She wouldn't say much about the novel except that it was based on the premise that the Chinese beat the Americans to the A-bomb by using a time machine to steal plutonium from the future. "After that, it gets a bit complex," she'd admitted, and Robyn had never pressed for more. Some questions were better left unasked.

"Slowly," Angela now replied. "But that's okay. The research is more fun than the writing." Which was what Robyn had always suspected.

The conversation drifted, while Robyn rang up Angela's purchase. Angela proffered a credit card, and Robyn swiped it, then froze, staring at her computer screen. "That's odd."

"What is?"

Old friendships have their privileges. Robyn beckoned Angela behind the counter so she too could see the monitor. "All of a sudden, you're an Amber. You've always before been perfectly Green."

Angela didn't at all like the sound of that. "What's an Amber?"

"A provisional category. I think it's new. Someone mentioned it last month at the bookseller's convention, but I wasn't paying a lot of attention." Robyn had been more interested in a three-cornered debate between a representative of the retailer's association, a government official, and a consumer advocate over whether retailers should be allowed to see their customers' color codes when they rang up purchases. Currently, retailers had the right to know who they were dealing with, but the debate had attracted a big, highly partisan crowd. "I think it means the program isn't sure how to classify you and you're going to get a visit from the FBI."

"But I haven't *done* anything."

"I know." Robyn's heart was sinking. This was worse than "odd." This must be what it was like to be a doctor, delivering a diagnosis of cancer. *You're sick,* *but we don't know how bad it is until we run more tests. Maybe it's curable, maybe not.* She and Angela both needed to think optimistically. "You're no more a terrorist than I am," she said. "And the computer must believe you have a decent chance of convincing the FBI of that, or it would have taken you straight to Orange." From what she'd heard, though, most people who tripped high-alert profiles never regained their Green status. Yellow was probably the best Angela could hope for. Still, you could live with Yellow, even if it was a big-time nuisance.

Unfortunately, the bad news wasn't over. Robyn pointed to a different part of the screen. "I'm afraid the bank just cancelled your card. They always do that for Reds and Oranges, so it's no surprise. They're afraid of being held liable if the card is used for terrorist purposes." *Try to be optimistic.* "They'll probably reinstate it once the FBI clears you."

Angela was normally pale, but her complexion was becoming pasty. "What do I do now?"

Robyn wanted to hug her friend, but was afraid that if she did, Angela would break down completely, when she needed to be as clear-headed as possible. "Start by conserving your cash." She paused. "And maybe we can figure out what went wrong, so you can explain it to the Feds."

"Sounds hopeless."

"Maybe not. When was the last time you used this card?" Robyn was still holding the offending piece of plastic. She handed it back to Angela as though it were a talisman that might magically reveal the answer.

Angela took the card mechanically, barely noticing it. She was staring out the window, struggling to focus her thoughts. "Last night . . . no, this morning. At the gas station. It worked fine then. My gosh, that was only a couple of hours ago."

"And you didn't do anything odd—like wheeling up a 500-gallon drum as though you were stocking up for the end of the world?"

Angela managed a wan smile. "No. I just filled the tank. The price was up, but that was all."

"So something must have happened after you left the gas station." Robyn also stared into space, then dropped her gaze to the counter. "Oh, no," she said. Her eyes shifted to the computer screen. "Oh, no, no, *no*."

Angela leaned closer. "What, Robyn? You know, don't you?"

Robyn's throat clenched, and for a moment she wasn't sure she could speak. "Oh, Angela," she said. "It's the *books*." She stared at her cash register as though it were an old friend who'd just slapped her in the face. "New security software, installed last week. The moment I swipe a card, my computer now uploads not only the total amount of the purchase, but all of the barcodes as well, including those from prior sales." She waved her free hand at Angela's stack of books—the wonderful, loveable books that were windows to the souls of their readers. She thought of how much you could learn about people, simply from what they chose to display on their shelves. "*Look* at the type of stuff you've been buying. Nuclear physics, survival guides, end-of-the-world novels, commentaries on Chairman Mao. You're the only person I know who actually *bought* Mao's *Little Red Book*. Remember, a long time ago, you made me special order it? And this little monster—" she tapped the card reader "—can find every purchase you've ever made with that card. They're all right there on my hard drive."

Robyn finally did give her friend a hug. When she'd first heard about the upgrade, she'd had qualms, but at the bookseller's convention a security specialist had persuaded her it was simply another way to increase everyone's safety. It had been an easy self-delusion because she'd had no real choice but to accept the upgrade unless she herself wanted to be branded a terrorist sympathizer. And now, look what had come of it.

"Oh, Angela," she said, "*please* tell me you're actually making progress on that novel—that you have a nice, fat stack of pages to show the FBI, explaining why you've been buying all those books. Because otherwise, you're *royally* screwed."

And so too was Robyn, because she could never again sell a book without wondering if the reader really, truly understood all of the messages implicit in the choice to buy one title rather than another.

Colin McKenzie was the millionth victim. At his age, he no longer went to many concerts, but he'd been waiting all summer to see his favorite oldies band, Willie Rocket and the Retro Geeks. To miss the crush for seats, he'd even shown up ninety minutes early, but here he was hung up in a security line that circled the concert hall and spilled into its parking lot like a coiled snake. Ever so slowly the line inched forward, as Colin measured the rate of progress and tried to persuade himself he'd get in before show time. But there was no way; the line was moving at a crawl, and Colin could hear the strains of the opening tune as he inched those final, agonizing feet toward the security checkpoint. A half-dozen guards were working separate stations, but it was still taking forever.

"I'm sorry about the delay," a baby-faced guard said as Colin pressed his thumb to a scanner. He looked young enough not to know the difference between Retro oldies and "Oh Susanna," but no-nonsense muscles bulged beneath his uniform, and his neck looked big enough to support a pile driver.

The guard's badge identified him as Kim Springer, an unmanly moniker he'd frequently considered changing. "We got drafted to test some new video-cameras tonight," he said, "Eventually, they'll help spot terrorists who try to change their appearances, but nobody thought to give us extra data lines, so they're really slow. But that's just a one-time glitch." When the system went national, pictures would be taken at thousands of checkpoints and fed to face- and body-recognition software that could compare each photo to prior images of the same person. It would take a while for enough data to be compiled to be useful, but eventually the system would be able to raise the alert whenever it spotted out-of-character changes in physical appearance, such as shaving off a long-worn beard or dying your hair gray—clues that someone whose profile was otherwise clean might nevertheless be up to something nefarious. Without the right data lines, though, the system was slow as molasses, and Kim was tired of apologizing for it.

Normally, Colin appreciated guards who explained what they were doing. It made the entire process less intimidating. And he supposed that telling people about the latest developments both reassured the public and sent a "don't try it" message to would-be terrorists. Now, though, Colin wished the guard would just get on with it.

Kim was doing his job as efficiently as the bulky equipment allowed. "Okay," he said as the Geeks finished their first number to rousing applause. "The camera's finally got your face. Now, turn around slowly so it can get you from all sides. That's good. You can face forward again."

Colin fidgeted while data traveled too slowly to and from a distant mainframe. Inside the concert hall, the Geeks segued into their second tune. Then the computer beeped, and the guard glanced at his monitor. "Oh, drat," he said. "You're another Yellow. Sorry, you can't go in, but you can get a refund over there." He pointed to a line that looked nearly as intimidating as the one Colin had just finished standing in. "Wow," he said, as though seeing it for the first time. "I knew we were getting a lot of these today."

At the moment, Colin wasn't concerned about anyone's plight but his own. "This is ridiculous," he said. "I've never had trouble anywhere else."

"And you may never have trouble again." Kim had heard of marginal Greens who flickered back and forth between Green and Yellow with each new profile upgrade—and some people's status appeared to depend on what type of event they were trying to get into. Kim had a good memory for faces, and he knew he'd sometimes admitted people to one event who he'd rejected for something else only a few days before. "But I can't let you in."

Colin still couldn't believe it. In his entire life he'd never done anything worse than getting a parking ticket. Now, after spending nearly two hours in line, he was being told that society couldn't risk letting him into the Geeks' concert. What did they think he'd try to do? Hex someone with a peace sign? Not even that—the Geeks were entirely nonpolitical. That's why they'd chosen the name "Geeks." Maybe the computer thought he'd assault someone with hair grease, although that was a bit before the band's time.

However young he was, the guard was well trained. At the first sign that Colin might flare into anger, his friendly demeanor slipped away and his body seemed to swell to even more formidable proportions. Colin wisely chose to remain calm. There was no way he was getting into the concert, and too much anger would merely elevate his status to Orange. "Can you at least tell me why?" he asked as mildly as possible.

Kim's muscles were still tense, but his hand was no longer stealing toward his gun. "Only in general terms," he said. "If you want more, you'll have to talk to the Antiterrorist Division's Ombudsman's Office." He glanced at the line still winding out into the parking lot and sighed. He enjoyed his job, but on days like this he wished he could just harden his heart and say, "Tough luck, now scram." The next hour wouldn't be pleasant, even if the plague of Yellows came to an end.

But part of his job was to minimize protests. Two minutes smoothing feathers now could save a lot of time later on, and if a subject's reaction was off-kilter—or simply indicated that he posed a danger to future guards—Kim had the authority to enter that into the database. He worked for the government, not the concert hall, and while efficiency was expected, tonight's snarl-up wasn't his fault.

"To start with," he said, "the cameras didn't like you, although they haven't liked much of anybody. One of the things they were supposed to do was compare your clothing to what people were expected to wear, looking for misfits. But something seems to have gone wrong. The program apparently wasn't expecting people to look quite so . . . normal." *That* was an understatement. Kim wasn't anywhere nearly as dumb as he liked to act, and earlier that evening he'd sneaked a peek at the pattern-recognition templates, which in the test program hadn't been password-protected. As far as he could tell, the software expected Geeks fans to dress like preppie Klingons.

With Colin calming down, Kim decided to risk a question that had been on his mind since he'd seen the templates. "Just what kind of spacey music does this Rocket fellow play, anyway? From what I can hear now, it doesn't sound much different from the stuff my mother likes."

"That's because it probably *is* her type of music," Colin said. Sadness had replaced his anger. "There's nothing 'spacey' about it. The Geeks do original music in the spirit of the '50s and '60s." The joy of a Geeks concert was that you weren't just listening to recycled oldies. It was like being young again and hearing your generation's music for the first time. "'Rocket' is just a made-up name.

The old bands loved names like that."

Kim nodded. It was just like software engineers to write a slick new pattern-recognition algorithm only to arm it with a brain-dead profile, based on somebody's off-the-wall guess. The only people Kim had *not* seen the dress-code program reject were two guys who gave *him* the heebie-jeebies, with chartreuse Mohawks and studded collars. Not that there weren't concert crowds in which that would be pretty tame.

Kim glanced at the line and toyed with giving Colin a polite brush-off. But Colin had answered his question, and it was only fair to reciprocate more fully. "As I said, the dress profile was only a test. The Yellow code came from our normal ID check. Nobody knows exactly how those things work, but for concerts, I've always suspected that in addition to the normal things, it looks at your music purchases to see if your tastes match the concert. If all you're buying is hip-hop, you might have trouble getting into a classical concert. And for big-crowd events like this, that Yellow flag goes up pretty easily, so it could be a lot more subtle than that.

"Also, when I first started doing concerts, my supervisor told me not to worry if some of you '60s types popped up with criminal records—especially protesting or drug-related charges. She's your age and likes to joke that if you can remember the '60s, you weren't really there. Obviously, lots of people got through that era without being caught, and a few, I suppose, really didn't inhale." Kim essayed a grin, but Colin wasn't in a bantering mood. "Anyway, from my boss's comments, I suspect that if the profiling program sees a squeaky-clean record it asks the same question. And everything about you radiates Mr. Clean."

"Yeah, that was me," Colin admitted. He still wasn't happy, but as he turned away, his disappointment was somewhat mollified. Being rejected wasn't fun, but it could have been worse: he had the irony of being rejected because he was too "good" for the profile—no weird clothes, no criminal record. And he hadn't purchased much music in years, so maybe that was the trigger. The whole thing had been strange and frustrating, but oddly affirming at the same time.

He barely glanced at the refund queue. He'd stood in line long enough; the Geeks could keep his money. It hadn't been an expensive concert, anyway.

Kim was pleased with himself as he watched Colin's departure. *I'd have made a good psychologist*, he thought, not for the first time. There had been no option but to turn the man away, but Kim had found a nice way to sugar the truth, which was that the computer suspected Colin of terrorism, and that however slight that suspicion might be, it was enough to deny him entry to a packed auditorium.

Kim's pleasure was undermined, however, by tonight's startling number of Yellows. Normally, in a crowd this size, there would only be a few dozen. Tonight, there must have been hundreds. At first, Kim had thought something about the band was drawing them out of the woodwork. But he himself was good at noticing patterns—not as good as a computer, but very good by human standards. As he beckoned the next concert-goer forward, Kim glanced again at his monitor, where he had yet to erase Colin's name.

Colin had been born on July 3, 1951. Nothing odd in that: it put him right in the middle of this crowd's age range. The pattern was in the numbers: Colin's birth date included no even digits. That had been the case with every reject Kim could remember. He'd noticed because earlier he'd rejected someone born on a September 11th, and that date of infamy had instantly caught his attention. At first he'd thought the 9-11 was the key, but he'd soon realized it was simply a reflection of a broader odd-numbers pattern.

Security guards loved to gossip about the profiles. The higher-ups didn't care because anything that could be deduced in this manner couldn't remain secret for long, anyway. And the speculation helped the guards give plausible-sounding explanations to people like Colin, few of whom were true terrorists.

Over the years, Kim had heard of profiles that looked like real lulus. But however strange they seemed, Kim had always had faith that the underlying patterns were sound, that the rumor mill had only picked up the surface of a pattern and missed complexities seen by the computers. The proof, as the old saying went, was in the pudding: terrorism had been steadily declining, so obviously, the profiles were doing something right.

Tonight, that faith had been shaken. Not only had Kim noticed that everyone who'd been Yellow-flagged had an odd-digit birth date, but once he'd spotted that pattern, he'd not seen anyone with such a birth date who'd *not* turned up Yellow. It made no sense. Even if there were subtler underlying factors, how could *that* many people possibly have terrorist leanings? And what would the country do if they did?

If terrorism is defined as the ability to wreak random havoc on large numbers of people, Jay Getman was the world's most dangerous active terrorist. Jay (JayG to his friends) was also a loyal citizen whose car boasted more flag-holders than any other on the block. He knew, because he kept count.

Jay accomplished his dual role by working for the government's Terror Prevention and Probability Assessment Unit, a small but high-powered agency whose entire staff could be housed on two floors of a modest office building.

The water-cooler gossip had it that Jay was the most innovative programmer in the unit—a compliment that was shorthand for "nobody else understands how his programs work." Jay was one of several rising stars, renowned for creating bold new algorithms that could spot an incipient attack practically before the terrorists knew their own plans. Before coming to the unit, he had helped the FBI track kidnappers via the trails of marked bills they left in their wakes once they started spending their loot. He'd also helped the Treasury Department track down more than a few counterfeiters.

Jay's early profiles had been works of beauty, and terror cells fell before them, right and left. But success breeds the need for ever-greater success. "The low-hanging fruit," as Jay liked to call it, had long ago been harvested. New programs had to ferret more deeply into the ordinary framework of society, seeking the best-hidden terrorists and their sympathizers.

Jay's boss usually shared his opinion of his own brilliance. Right now, though, she wasn't all that pleased with him.

"Do you know how many hits we had last night?" Roberta Holmann demanded. Jay was silent. It was unwise to answer Roberta's rhetorical questions. Besides, when Roberta was chewing you out, she barely paused to draw breath. "More than three-quarters of a million, that's how many. What the Hell caused that? Even if all those people are bent, the FBI can't handle that many. What good's a terrorist tracking system that thinks *everyone* is a terrorist?"

"Seven hundred fifty thousand people isn't exactly *everyone*—" Jay started to protest, until Roberta's glare cut him off. "But it won't happen again. I'll get right on it."

Jay knew what had gone wrong, although he wasn't going to admit it yet. It was that damn birth date thing. A few months ago, the Israelis had cracked a not-too-bright Black September spin-off whose leader had tried to commemorate the original group by using the date of its demise (somewhat arbitrarily chosen as March 5, 1973) as the date of birth on more than a dozen fake IDs. Jay had learned that fascinating tidbit late yesterday, after spending most of the day working on how to make face recognition software spot the difference between normal changes in a person's hairstyle and deliberate attempts to hide your identity. It wasn't an easy problem. After all, how many people have had the misfortune of looking at old pictures of themselves and wondering what on Earth had ever possessed them to look like *that*? But Jay was sure he'd crack it eventually. It was mostly a matter of looking for changes that went counter to trends: hipsters who turned nebbish; middle-aged men who, without obvious stimuli such as divorce, took up the latest teenage styles.

Then someone had e-mailed him the Black September tidbit and he'd decided it might pay to Yellow-flag other folks listing the same birthday, just in case a few cell members had escaped. Unfortunately, he'd had a hot date that night—even now, his mind was still on Lisa of the long, brown hair and even longer legs. In his haste, he borrowed a few lines of code from another program, and the result appeared to have picked out all birth dates comprised entirely of 1s, 3s, 5s, 7s, and 9s, rather than what he'd intended. Lisa's birthday was November 11, 1977, and he'd figured out his mistake when a bouncer wouldn't let her into the club where they'd intended to spend the evening.

If Jay had explained this to Roberta, she would have rolled her eyes, muttered something about "you and your women," and told him not to write code when he had sex on the brain. All of which Jay knew perfectly well. But he was a star, and he'd been hoping to get lucky and nail a terrorist at the same time as he was scoring with Lisa. He'd botched both, but being a star meant not letting anyone know when things weren't perfect.

Jay booted up his computer and set about fixing his mistake. When Roberta asked for a report, later in the day, he'd have to tell her what went wrong, but maybe he could spout programming jargon and not admit quite how simple his gaffe had been.

Meanwhile, he also had to tend to that fiasco with the dress-code software. At least he'd not been the genius who'd somehow converted Willie Rocket and the Retro Geeks into Buck Rogers and the Space Aliens.

Thousands of miles away, another man also hunched over a computer. Most people knew him only as Jakob, which was convenient, because he had as many last names as he had passports, and his vaguely European accent allowed him to pass as a national of any of the many countries in which his was a common first name. Under any of his identities, Jakob's fingerprints would instantly have tested Green on Jay Getman's profiles, although Jakob's days of risking his neck in the field were long gone.

Jakob viewed himself as a consultant. His clients included many of the world's formerly most dangerous terrorists, now largely retired. Initially they had been surprised by the power of the Americans' profiles. The early ones had been accurate, well focused, and deadly to entire organizations. But Jakob knew the virtue of patience and counseled his clients to remember it.

A wise enemy once described terror as a "weapon of mass distraction" which continues to function even when terrorists can't risk exposure by actually *doing* anything. "Bide your time," Jakob had advised his fellows. "Let the Americans become their own terrorists."

Not all of his colleagues agreed, but most of those were foolish and had been easily caught. Then the Americans had run out of catchable terrorists and began to improvise, using the world's most sophisticated forensic tools to chase people who looked less and less like Jakob's clients.

These days, Jakob had two jobs. One was to monitor the media for signs of backlash. When these appeared, the best reaction was to tell a client to sacrifice one of its cells in a real attack—just severe enough to remind people that the threat still existed. The other task was to give the profilers something to chase. Usually, the two jobs overlapped, as in that silly Black September thing. Nobody really expected the new Septemberists to survive long enough to mount a major attack—not with all those identical birth dates pointing to them like a giant neon sign. Those people had been idiots and *deserved* to be sacrificed. Jakob's goal had been to make his enemies start looking at birth dates, thereby encouraging them to harass yet another segment of their own population.

Then the profilers had gone overboard and wrecked the whole thing. The Internet and the news services were abuzz with speculation, and a few editorials were suggesting that maybe the Probability Assessment Unit had completed its job and needed to be scaled back. Jakob was also getting reports about the Willie Rocket glitch and several other strange incidents that smacked of bureaucratic stupidity and at least one cowboy profiler. It would only take a few more such incidents for the public to start reconsidering its commitment to profiling.

The profilers needed a wake-up lesson that would encourage them to focus their efforts, while still inducing them to chase phantoms. But for once, Jakob had no idea how to proceed.

The very next morning, Jakob got lucky, although he didn't know it at the time. JayG was found in an alley, face down in a puddle of his own blood. The murder weapon, a pipe wrench, was in a nearby dumpster. The only prints on it traced to a plumber who had an alibi and claimed the tool had been stolen.

The crime was an ordinary mugging. Still smarting under his rebuke from Roberta, Jay had invited Lisa to help him unwind with a second night on the town. Instead she'd dumped him, and his unwinding turned into a sorrow-drowning bar-hop through a series of increasingly disreputable taverns, where he'd flashed a big wad of currency one too many times. But Roberta was certain that her programmer had been deliberately targeted. She had the murder coded as an assassination and reminded her staff that profiling wasn't a game: everyone's safety was on the line, including their own. "Stay focused, folks," she added, just to make sure they got the point. "No more space aliens or coding screw-ups. There are real terrorists out there, and *those* are the people we're after."

Her advice had mixed results. Code quality did indeed improve. But the pattern-recognition software had become so complex that changes could send unpredictable ripples though the entire system. In the next few weeks, hardware purchases were more likely to be Yellow-flagged, and plumbing contractors were turned away from sporting events and airplanes. But other than a few puzzled plumbers and store owners, nobody really noticed.

Eventually, Jakob learned of Jay's death from the intelligence service of a sympathetic government. Shortly after, another man was found dead in an alley. A routine search of his apartment uncovered a cache of documents containing personal data about employees of the Terror Prevention and Probability Assessment Unit, particularly one Jay Getman. The man's history couldn't be traced back all the way to the date of Jay's death, but he carried fake identification claiming that, like all of those Black Septemberists, he was born on March 5, 1973.

Jakob was back in business.

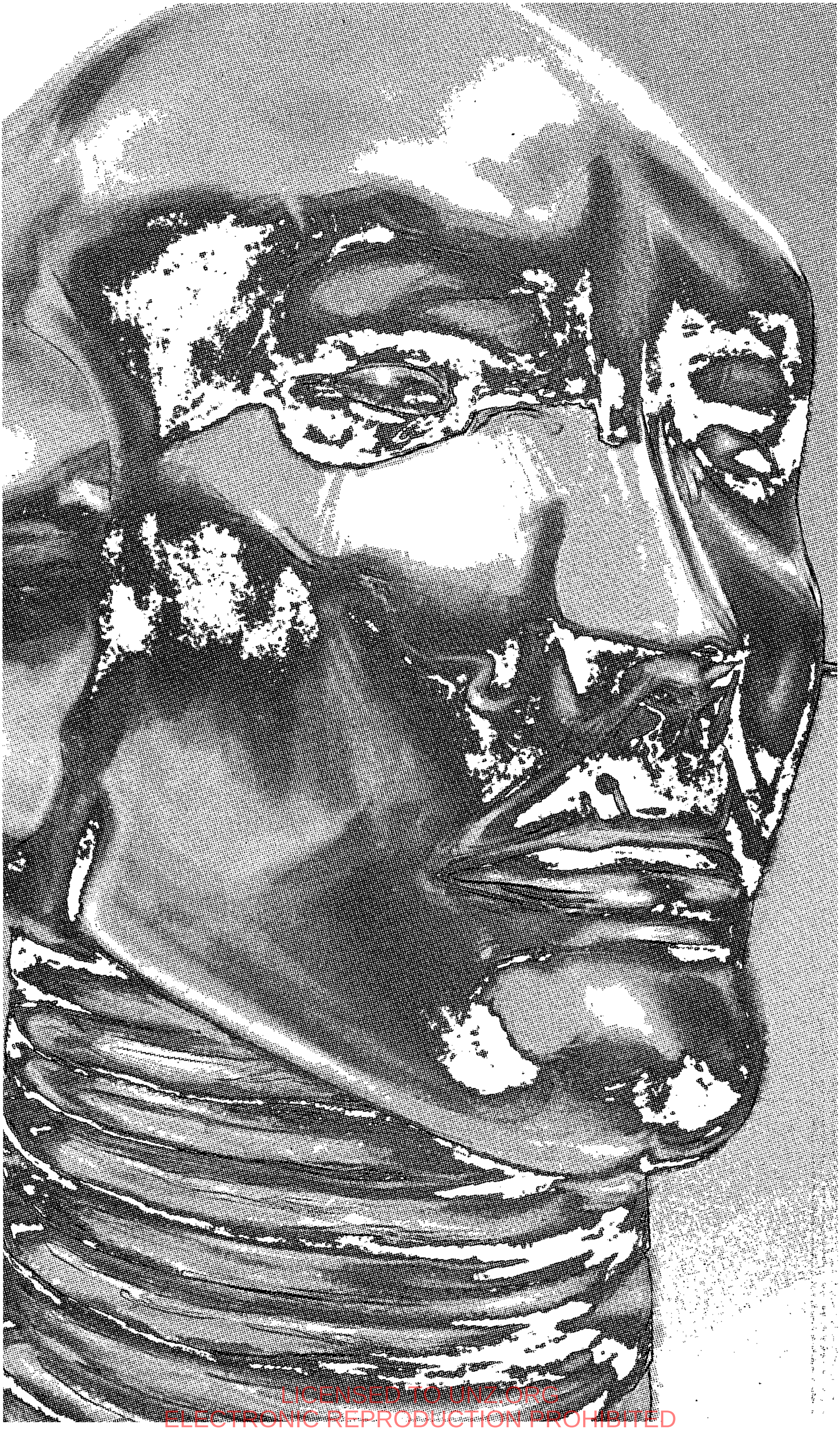
So too was the Probability Assessment Unit. ■

Shed Skin

Robert J. Sawyer

Illustration by Nicholas Jainschigg

Some decisions seem much simpler before you make them than after.



"I'm sorry," said Mr. Shiozaki, as he leaned back in his swivel chair and looked at the middle-aged white man with the graying temples, "but there's nothing I can do for you."

"But I've changed my mind," said the man. He was getting red in the face as the conversation went on. "I want out of this deal."

"You can't change your mind," said Shiozaki. "You've *moved* your mind."

The man's voice had taken on a plaintive tone, although he was clearly trying to suppress it. "I didn't think it would be like this."

Shiozaki sighed. "Our psychological counselors and our lawyers went over the entire procedure and all the ramifications with Mr. Rathburn beforehand. It's what he wanted."

"But I don't want it anymore."

"You don't have any say in the matter."

The white man placed a hand on the table. The hand was flat, the fingers splayed, but it was nonetheless full of tension. "Look," he said, "I demand to see—to see the other me. I'll explain it to him. He'll understand. He'll agree that we should rescind the deal."

Shiozaki shook his head. "We can't do that. You know we can't. That's part of the agreement."

"But—"

"No buts," said Shiozaki. "That's the way it *has* to be. No successor has *ever* come back here. They can't. Your successor has to do everything possible to shut your existence out of his mind, so he can get on with *his* existence, and not worry about yours. Even if he wanted to come see you, we wouldn't allow the visit."

"You can't treat me like this. It's inhuman."

"Get this through your skull," said Shiozaki. "*You* are not human."

"Yes, I am, damn it. If you—"

"If I prick you, do you not bleed?" said Shiozaki.

"Exactly! *I'm* the one who is flesh and blood. I'm the one who grew in my mother's womb. I'm the one who is a descendant of thousands of generations of *Homo sapiens* and thousands of generations of *Homo erectus* and *Homo habilis* before that. This—this other me is just a machine, a robot, an android."

"No, it's not. It is George Rathburn. The one and only George Rathburn."

"Then why do you call him 'it'?"

"I'm not going to play semantic games with you," said Shiozaki. "*He* is George Rathburn. You aren't—not anymore."

The man lifted his hand from the table and clenched his fist. "Yes, I am. I *am* George Rathburn."

"No, you're not. You're just a skin. Just a shed skin."

George Rathburn was slowly getting used to his new body. He'd spent six months in counseling preparing for the transference. They'd told him this replacement body wouldn't feel like his old one, and they'd been right. Most people didn't transfer until they were old, until they'd enjoyed as much biological physicality as they could—and until the ever-improving robotic technology was as good as it was going to get during their natural lifetimes.

After all, although the current robot bodies were superior in many ways to the slab-of-flab ones—how soon he'd adopted that term!—they still weren't as physically sensitive.

Sex—the recreational act, if not the procreative one—was possible, but it wasn't quite as good. Synapses were fully reproduced in the nano-gel of the new brain, but hormonal responses were faked by playing back memories of previous events. Oh, an orgasm was still an orgasm, still wonderful—but it wasn't the unique, unpredictable experience of a real sexual climax. There was no need to ask, "Was it good for you?," for it was *always* good, always predictable, always exactly the same.

Still, there were compensations.

George could now walk—or run, if he wanted to—for hours on end without feeling the slightest fatigue. And he'd dispensed with sleep. His daily memories were organized and sorted in a six-minute packing session every twenty-four hours; that was his only downtime.

Downtime. Funny that it had been the biological version of him that had been prone to downtime, while the electronic version was mostly free of it.

There were other changes, too. His proprioception—the sense of how his body and limbs were deployed at any given moment—was much sharper than it had previously been.

And his vision was more acute. He couldn't see into the infrared—that was technically possible, but so much of human cognition was based on the idea of darkness and light that to banish them with heat sensing had turned out to be bad psychologically. But his chromatic abilities had been extended in the other direction, and that let him see, among other things, bee purple, the color that often marked distinctive patterns on flower petals that human eyes—the old-fashioned kind of human eyes, that is—were blind to.

Hidden beauty revealed.

And an eternity to enjoy it.

"I demand to see a lawyer."

Shiozaki was again facing the flesh-and-blood shell that had once housed George Rathburn, but the Japanese man's eyes seemed to be focused at infinity, as if looking right through him. "And how would you pay for this lawyer's services?" Shiozaki asked at last.

Rathburn—perhaps he couldn't use his name in speech, but no one could keep him from thinking it—opened his mouth to protest. He had money—lots of money. But, no, no, he'd signed all that away. His biometrics were meaningless; his retinal scans were no longer registered. Even if he could get out of this velvet prison and access one, no ATM in the world would dispense cash to him. Oh, there were plenty of stocks and bonds in his name . . . but it wasn't *his* name anymore.

"There has to be something you can do to help me," said Rathburn.

"Of course," said Shiozaki. "I can assist you in any number of ways. Anything at all you need to be comfortable here."

"But *only* here, right?"

"Exactly. You knew that—I'm sorry; *Mr. Rathburn* knew that when he chose this path for himself, and for you. You will spend the rest of your life here in Paradise Valley."

Rathburn was silent for a time, then: "What if I agreed to accept your restrictions? What if I agreed *not* to present myself as George Rathburn? Could I leave here then?"

"You *aren't* George Rathburn. Regardless, we can't allow you to have any outside contact." Shiozaki was quiet for a few moments, and then, in a softer tone, he said, "Look, why make things difficult for yourself? Mr. Rathburn provided very generously for you. You will live a life of luxury here. You can access any books you might want, any movies. You've seen our recreation center, and you must admit it's fabulous. And our sex-workers are the best-looking on the planet. Think of this as the longest, most-pleasant vacation you've ever had."

"Except it doesn't end until I die," said Rathburn.

Shiozaki said nothing.

Rathburn exhaled noisily. "You're about to tell me that I'm already dead, aren't you? And so I shouldn't think of this as a prison; I should think of this as heaven."

Shiozaki opened his mouth to speak, but closed it again without saying anything. Rathburn knew that the administrator couldn't even give him that comfort. He wasn't dead—nor would he be, even when this discarded biological container, here, in Paradise Valley, finally ceased to function. No, George Rathburn lived on, a duplicated version of this consciousness in an almost indestructible, virtually immortal robot body, out in the real world.

"Hey there, G.R.," said the black man with the long gray beard. "Join me?"

Rathburn—the Rathburn made out of carbon, that is—had entered Paradise Valley's dining hall. The man with the beard had already been served his lunch: a lobster tail, garlic mashed potatoes, a glass of the finest Chardonnay. The food here was exquisite.

"Hi, Dat," Rathburn said, nodding. He envied the bearded man. His name, before he'd transferred his consciousness into a robot, had been Darius Allan Thompson, so his initials, the only version of his birth name allowed to be used here, made a nice little word—almost as good as having a real name. Rathburn took a seat at the same table. One of the ever-solicitous servers—young, female (for this table of straight men), beautiful—was already at hand, and G.R. ordered a glass of champagne. It wasn't a special occasion—nothing was ever special in Paradise Valley—but any pleasure was available to those, like him and Dat, on the Platinum Plus maintenance plan.

"Why so long in the face, G.R.?" asked Dat.

"I don't like it here."

Dat admired the *derrière* of the departing server, and took a sip of his wine. "What's not to like?"

"You used to be a lawyer, didn't you? Back on the outside?"

"I still *am* a lawyer on the outside," said Dat.

G.R. frowned, but decided not to press the point. "Can you answer some questions for me?"

"Sure. What do you want to know?"

G.R. entered Paradise Valley's "hospital." He thought of the name as being in quotation marks, since a real hospital was a place you were supposed to go to only temporarily for healing. But most of those who had uploaded their consciousness, who had shed their skins, were elderly. And when their discarded shells checked into the hospital, it was to die. But G.R. was only forty-five. With proper medical treatment, and some good luck, he had a fair chance of seeing one hundred.

G.R. went into the waiting room. He'd watched for two weeks now, and knew the schedule, knew that little Lilly Ng—slight, Vietnamese, fifty—would be the doctor on duty. She, like Shiozaki, was staff—a real person who got to go home, to the real world, at night.

After a short time, the receptionist said the time-honored words: "The doctor will see you now."

G.R. walked into the green-walled examination room. Ng was looking down at a datapad. "GR-7," she said, reading his serial number. Of course, he wasn't the only one with the initials G.R. in Paradise Valley, and so he had to share what faint echo of a name he still possessed with several other people. She looked at him, her gray eyebrows raised, waiting for him to confirm that that was indeed who he was.

"That's me," said G.R., "but you can call me George."

"No," said Ng. "I cannot." She said it in a firm but gentle tone; presumably, she'd been down this road before with others. "What seems to be the problem?"

"I've got a skin tag in my left armpit," he said. "I've had it for years, but it's started to get sensitive. It hurts when I apply roll-on deodorant, and it chafes as I move my arm."

Ng frowned. "Take off your shirt, please."

G.R. began undoing buttons. He actually had several skin tags, as well as a bunch of moles. He also had a hairy back, which he hated. One reason uploading his consciousness had initially seemed appealing was to divest himself of these dermal imperfections. The new golden robot body he'd selected—looking like a cross between the Oscar statuette and C-3PO—had no such cosmetic defects.

As soon as the shirt was off, he lifted his left arm and let Ng examine his axilla.

"Hmm," she said, peering at the skin tag. "It does look inflamed."

G.R. had brutally pinched the little knob of skin an hour before, and had twisted it as much as he could in either direction.

Ng was now gently squeezing it between thumb and forefinger. G.R. had been prepared to suggest a treatment, but it would be better if she came up with the idea herself. After a moment, she obliged. "I can remove it for you, if you like."

"If you think that's the right thing to do," said G.R.

"Sure," said Ng. "I'll give you a local anesthetic, clip it off, and cauterize the cut. No need for stitches."

Clip it off? No! No, he needed her to use a scalpel, not surgical scissors. Damn it!

She crossed the room, prepared a syringe, and returned, injecting it directly into the skin tag. The needle going in was excruciating—for a few moments. And then there was no sensation at all.

"How's that?" she asked.

"Fine."

Ng put on surgical gloves, opened a cupboard, and pulled out a small leather case. She placed it on the examination table G.R. was now perched on, and opened it. It contained surgical scissors, forceps, and—

They glinted beautifully under the lights from the ceiling.

A pair of scalpels, one with a short blade, the other with a longer one.

"All right," said Ng, reaching in and extracting the scissors. "Here we go . . ."

G.R. shot his right arm out, grabbing the long-bladed scalpel, and quickly swung it around, bringing it up and under Ng's throat. Damn but the thing was sharp! He hadn't meant to hurt her, but a shallow slit two centimeters long now welled crimson across where her Adam's apple would have been had she been a man.

A small scream escaped from Ng, and G.R. quickly clamped his other hand over her mouth. He could feel her shaking.

"Do exactly as I say," he said, "and you'll walk out of this alive. Screw me over, and you're dead."

"Don't worry," said Detective Dan Lucerne to Mr. Shiozaki. "I've handled eight hostage situations over the years, and in every case, we've managed a peaceful solution. We'll get your woman back."

Shiozaki nodded then looked away, hiding his eyes from the detective. He should have recognized the signs in GR-7. If only he'd ordered him sedated, this never would have happened.

Lucerne gestured toward the vidphone. "Get the examination room on this thing," he said.

Shiozaki reached over Lucerne's shoulder and tapped out three numbers on the keypad. After a moment, the screen came to life, showing Ng's hand pulling away from the camera at her end. As the hand withdrew, it was clear that G.R. still had the scalpel held to Ng's neck.

"Hello," said Lucerne. "My name is Detective Dan Lucerne. I'm here to help you."

"You're here to save Dr. Ng's life," said GR-7. "And if you do everything I want, you will."

"All right," said Lucerne. "What do you want, sir?"

"For starters, I want you to call me Mr. Rathburn."

"Fine," said Lucerne. "That's fine, Mr. Rathburn."

Lucerne was surprised to see the shed skin tremble in response. "Again," GR-7 said, as if it were the sweetest sound he'd ever heard. "Say it again."

"What can we do for you, Mr.

Rathburn?"

"I want to talk to the robot version of me."

Shiozaki reached over Lucerne's shoulder again, pushing the mute button. "We can't allow that."

"Why not?" asked Lucerne.

"Our contract with the uploaded version specifies that there will never be any contact with the shed skin."

"I'm not worried about fine print," said Lucerne. "I'm trying to save a woman's life." He took the mute off. "Sorry about that, Mr. Rathburn."

GR-7 nodded. "I see Mr. Shiozaki standing behind you. I'm sure he told you that what I wanted isn't permitted."

Lucerne didn't look away from the screen, didn't break the eye contact with the skin. "He did say that, yes. But he's not in charge here. *I'm* not in charge here. It's your show, Mr. Rathburn."

Rathburn visibly relaxed. Lucerne could see him back the scalpel off a bit from Ng's neck. "That's more like it," he said. "All right. All right. I don't want to kill Dr. Ng—but I will unless you bring the robot version of me here within three hours." He spoke out of the side of his mouth to Ng. "Break the connection."

A terrified-looking Ng reached her arm forward, her pale hand and simple gold wedding ring filling the field of view.

And the screen went dead.

George Rathburn—the silicon version—was sitting in the dark, wood-paneled living room of his large Victorian-style country house. Not that he had to sit; he never grew tired anymore. Nor did he really need his chairs to be padded. But folding his metal body into the seat still felt like the natural thing to do.

Knowing that, barring accidents, he was now going to live virtually forever, Rathburn figured he should tackle something big and ambitious, like *War and Peace* or *Ulysses*. But, well, there would always be time for that later. Instead, he downloaded the latest Buck Doheney mystery novel into his datapad, and began to read.

He'd only gotten halfway through the second screenful of text when the datapad bleeped, signaling an incoming call.

Rathburn thought about just letting the pad record a message. Already, after only a few weeks of immortality, nothing seemed particularly urgent. Still, it might be Kathryn. He'd met her at the training center, while they were both getting used to their robot bodies, and to their immortality. Ironically, she'd been eighty-two before she'd uploaded; in his now-discarded flesh-and-blood shell, George Rathburn would never have had a relationship with a woman so much older than he was. But now that they were both in artificial bodies—his gold, hers a lustrous bronze—they were well on the way to a full-fledged romance.

The pad bleeped again, and Rathburn touched the ANSWER icon—no need to use a stylus anymore; his synthetic fingers didn't secrete oils that would leave a mark on the screen.

Rathburn had that strange feeling he'd experienced once or twice since uploading—the feeling of deep surprise that would have been accompanied by his old heart skipping a beat. "Mr. Shiozaki?" he said. "I didn't expect to ever see you again."

"I'm sorry to have to bother you, George, but we've—well, we've got an emergency. Your old body has taken a hostage here in Paradise Valley."

"What? My God . . ."

"He's saying he will kill the woman if we don't let him talk to you."

George wanted to do the right thing, but . . .

But he'd spent weeks now trying to forget that another version of him still existed. "I—um—I *guess* it'd be okay if you put him on."

Shiozaki shook his head. "No. He

won't take a phone call. He says you have to come here in person."

"But . . . but you said . . ."

"I know what we told you during counseling, but, damn it, George, a woman's life is at stake. You might be immortal now, but she isn't."

Rathburn thought for another few seconds, then: "All right. All right. I can be there in a couple of hours."

The robot-bodied George Rathburn was shocked by what he was seeing on the vidphone in Shiozaki's office. It was him—just as he remembered himself. His soft, fragile body; his graying temples; his receding hairline; his nose that he'd always thought was too large.

But it was him doing something he never could have imagined doing—holding a surgical blade to a woman's throat.

Detective Lucerne spoke toward the phone's pickups. "Okay," he said. "He's here. The other you is here."

On the screen, Rathburn could see his shed skin's eyes go wide as they beheld what he'd become. Of course, that version of him had selected the golden body—but it had only been an empty shell then, with no inner workings. "Well, well, well," said G.R. "Welcome, brother."

Rathburn didn't trust his synthesized voice, so he simply nodded.

"Come on down to the hospital," said G.R. "Go to the observation gallery above the operating theater; I'll go to the operating theater itself. We'll be able to see each other—and we'll be able to talk, man to man."

"Hello," said Rathburn. He was standing on his golden legs, staring through the angled sheet of glass that overlooked the operating room.

"Hello," said GR-7, looking up. "Before we go any further, I need you to prove that you are who you say you are. Sorry about this, but, well, it could be *anyone* inside that robot."

"It's me," said Rathburn.

"No. At best it's one of us. But I've got to be sure."

"So ask me a question."

GR-7 was clearly prepared for this. "The first girl to ever give us a blowjob."

"Carrie," said Rathburn, at once. "At the soccer field."

GR-7 smiled. "Good to see you, brother."

Rathburn was silent for a few moments. He swiveled his head on noiseless, frictionless bearings, looking briefly at Lucerne's face, visible on a vidphone out of view of the observation window. Then he turned back to his shed skin. "I, ah, I understand you want to be called George."

"That's right."

But Rathburn shook his head. "We—you and I, when we were one—shared exactly the same opinion about this matter. We wanted to live forever. And that can't be done in a biological body. You *know* that."

"It can't be done *yet* in a biological body. But I'm only forty-five. Who knows what technology will be available in the rest of our—of *my*—lifetime?"

Rathburn no longer breathed—so he could no longer sigh. But he moved his steel shoulders while feeling the emotion that used to produce a sigh. "You know why we chose to transfer early. You have a genetic predisposition to fatal strokes. But I don't have that—George Rathburn doesn't have that anymore. *You* might check out any day now, and if we hadn't transferred our consciousness into this body, there would have been no immortality for us."

"But we didn't *transfer* consciousness," said GR-7. "We *copied* consciousness—bit for bit, synapse for synapse. You're a copy. *I'm* the original."

"Not as a matter of law," said Rathburn. "You—the biological you—signed the contract that authorized the transfer of personhood. You signed it with the same hand you're using to hold that scalpel to Dr. Ng's throat."

"But I've changed my mind."

"You don't have a mind *to* change. The software we called the mind of George Rathburn—the only legal version of it—has been transferred from the hardware of your biological brain to the hardware of our new body's nano-gel CPU." The robotic Rathburn paused. "By rights, as in any transfer of software, the original should have been destroyed."

GR-7 frowned. "Except that society wouldn't allow for that, any more than it would allow for physician-assisted suicide. It's illegal to terminate a source body, even after the brain has been transferred."

"Exactly," said Rathburn, nodding his robotic head. "And you have to activate the replacement before the source dies, or else the court will determine that there's been no continuity of personhood and dispose of the assets. Death may not be certain anymore, but taxes certainly are."

Rathburn had hoped GR-7 would laugh at that, hoped that a bridge could be built between them. But GR-7 simply said, "So I'm stuck here."

"I'd hardly call it 'stuck,'" said Rathburn. "Paradise Valley is a little piece of heaven here on Earth. Why not just enjoy it, until you really do go to heaven?"

"I *hate* it here," said GR-7. He paused. "Look, I accept that by the current wording of the law, I have no legal standing. All right, then. I can't make them nullify the transfer—but *you* can. You are a person in the eyes of the law; you can do this."

"But I don't want to do it. I like being immortal."

"But *I* don't like being a prisoner."

"It's not me that's changed," said the android. "It's you. Think about what you're doing. We were never violent. We would never dream of taking a hostage, of holding a knife to someone's throat, of frightening a woman half to death. You're the one who has changed."

But the skin shook his head. "Nonsense. We'd just never been in such desperate circumstances before. Desperate circumstances make one do desperate things. The fact that you can't conceive of us doing this means that you're a *flawed* copy. This—this transfer process isn't ready for prime time yet. You should nullify the copy and let me, the original, go on with your—with our—life."

It was now the robotic Rathburn's turn to shake his head. "Look, you must realize that this can't ever work—that even if I were to sign some paper that transferred our legal status back to you, there are witnesses here to testify that I'd been coerced into signing it. It would have no legal value."

"You think you can outsmart me?" said GR-7. "I *am* you. Of course I know that."

"Good. Then let that woman go."

"You're not thinking," said GR-7. "Or at least you're not thinking hard enough. Come on, this is *me* you're talking to. You must know I'd have a better plan than that."

"I don't see. . . ."

"You mean you don't want to see. Think, Copy of George. Think."

"I still don't . . ." The robotic Rathburn trailed off. "Oh. No, no, you can't expect me to do that."

"Yes, I do," said GR-7.

"But . . ."

"But what?" The skin moved his free hand—the one not holding the scalpel—in a sweeping gesture. "It's a simple proposition. Kill yourself, and your rights of personhood will default back to me. You're correct that, right now, I'm not a person under the law—meaning I can't be charged with a crime. So I don't have to worry about going to jail for anything I do now. Oh, they might try—but I'll ultimately get off, because if I don't, the court will have to admit that not just me, but all of us here in Paradise Valley are still human beings, with human rights."

"What you're asking is impossible."

"What I'm asking is the only thing that makes sense. I talked to a friend who used to be a lawyer. The personhood rights *will* revert if the original is still alive, but the uploaded version isn't. I'm sure no one ever intended the law to be used for this purpose; I'm told it was designed to allow product-liability suits if the robot brain failed shortly after transfer. But regardless, if you kill yourself, *I* get to go back to being a free human." GR-7 paused for a moment. "So what's it going to be? Your pseudolife, or the real flesh-and-blood life of this woman?"

"George . . ." said the robot mouth. "Please."

But the biological George shook his head. "If you really believe that you, as a copy of me, are more real than the original that still exists—if you really believe that you have a soul, just like this woman does, inside your robotic frame—then there's no particular reason why you should sacrifice yourself for Dr. Ng here. But if, down deep, you're thinking that I'm correct, that she really is alive, and you're not, then you'll do the right thing." He pressed the scalpel's blade in slightly, drawing blood again. "What's it going to be?"

George Rathburn had returned to Shiozaki's office, and Detective Lucerne was doing his best to persuade the robot-housed mind to agree to GR-7's terms.

"Not in a million years," said Rathburn, "and, believe me, I intend to be around that long."

"But another copy of you can be made," said Lucerne.

"But it won't be *me*—this me."

"But that woman, Dr. Ng: she's got a husband, three daughters . . ."

"I'm not insensitive to that, Detective," said Rathburn, pacing back and forth on his golden mechanical legs. "But let me put it to you another way. Say this is 1875, in the southern US. The Civil War is over, blacks in theory have the same legal status as whites. But a white man is being held hostage, and he'll only be let go if a black man agrees to sacrifice himself in the white man's place. See the parallel? Despite all the courtroom wrangling that was done to make uploaded life able to maintain the legal status, the personhood, of the original, you're asking me to set that aside, and reaffirm what the whites in the south felt they knew all along: that, all legal mumbo-jumbo to the contrary, a black man is worth less than a white man. Well, I won't do that. I wouldn't affirm that racist position, and I'll be damned if I'll affirm the modern equivalent: that a silicon-based person is worth less than a carbon-based person."

"'I'll be damned,'" repeated Lucerne, imitating Rathburn's synthesized voice. He let the comment hang in the air, waiting to see if Rathburn would respond to it.

And Rathburn couldn't resist. "Yes, I know there are those who would say I *can't* be damned—because whatever it is that constitutes the human soul isn't recorded during the transference process. That's the gist of it, isn't it? The argument that I'm not really human comes down to a theological assertion: I can't be human, because I have no soul. But I tell you this, Detective Lucerne: I feel every bit as alive—and every bit as spiritual—as I did before the transfer. I'm convinced that I *do* have a soul, or a divine spark, or an *élan vital*, or whatever you want to call it. My life in this particular packaging of it is *not* worth one iota less than Dr. Ng's, or anyone else's."

Lucerne was quiet for a time, considering. "But what about the other you? You're willing to stand here and tell me that that version—the original, flesh-and-blood version—is *not* human anymore. And you would have that distinction by legal fiat, just as blacks were denied human rights in the old south."

"There's a difference," said Rathburn. "There's a big difference. That version of me—the one holding Dr. Ng hostage—

agreed of its own free will, without any coercion whatsoever, to that very proposition. He—*it*—agreed that it would no longer be human, once the transfer into the robot body was completed."

"But he doesn't want it to be that way anymore."

"Tough. It's not the first contract that he—that *I*—signed in my life that I later regretted. But simple regret isn't reason enough to get out of a legally valid transaction." Rathburn shook his robotic head. "No, I'm sorry. I refuse. Believe me, I wish more than anything that you could save Dr. Ng—but you're going to have to find another way to do it. There's too much at stake here for *my* people—for uploaded humans—to let me make any other decision."

"All right," Lucerne finally said to the robotic Rathburn, "I give up. If we can't do it the easy way, we're going to have to do it the hard way. It's a good thing the old Rathburn wants to see the new Rathburn directly. Having him in that operating room while you're in the overlooking observation gallery will be perfect for sneaking a sharpshooter in."

Rathburn felt as though his eyes should go wide, but of course they did not. "You're going to shoot him?"

"You've left us no other choice. Standard procedure is to give the hostage-taker everything he wants, get the hostage back, then go after the criminal. But the only thing he wants is for you to be dead—and you're not willing to cooperate. So we're going to take him out."

"You'll use a tranquilizer, won't you?"

Lucerne snorted. "On a man holding a knife to a woman's throat? We need something that will turn him off like a light, before he's got time to react. And the best way to do that is a bullet to the head or chest."

"But . . . but I don't want you to kill him."

Lucerne made an even louder snort. "By your logic, he's not alive anyway."

"Yes, but . . ."

"But what? You willing to give him what he wants?"

"I can't. Surely you can see that."

Lucerne shrugged. "Too bad. I was looking forward to being able to quip 'Goodbye, Mr. Chips.'"

"Damn you," said Rathburn. "Don't you see that it's because of that sort of attitude that I *can't* allow this precedent?"

Lucerne made no reply, and after a time Rathburn continued. "Can't we fake my death somehow? Just enough for you to get Ng back to safety?"

Lucerne shook his head. "GR-7 demanded proof that it was really you inside that tin can. I don't think he can be easily fooled. But you know him better than anyone else. Could you be fooled?"

Rathburn tipped his mechanical head down. "No. No, I'm sure he'll demand positive proof."

"Then we're back to the sharpshooter."

Rathburn walked into the observation gallery, his golden feet making soft metallic clangs as they touched the hard, tiled floor. He looked through the angled glass, down at the operating room below. The slab-of-flab version of himself had Dr. Ng tied up now, her hands and feet bound with surgical tape. She couldn't get away, but he no longer had to constantly hold the scalpel to her throat. GR-7 was standing up, and she was next to him, leaning against the operating table.

The angled window continued down to within a half-meter of the floor. Crouching below its sill was Conrad Burloak, the sharpshooter, in a gray uniform, holding a black rifle. A small transmitter had been inserted in Rathburn's camera hardware, copying everything his glass eyes were seeing onto a datapad Burloak had with him.

In ideal circumstances, Burloak had said, he liked to shoot for the head, but here he was going to have to fire through the plate-glass window, and that might deflect the bullet slightly. So he was going to aim for the center of the torso, a bigger target. As soon as the datapad showed a clean line-of-fire at G.R., Burloak would pop up and blow him away.

"Hello, George," said the robotic Rathburn. There was an open intercom between the observation gallery and the operating theater below.

"All right," said the fleshy one. "Let's get this over with. Open the access panel to your nano-gel braincase, and . . ."

But GR-7 trailed off, seeing that the robotic Rathburn was shaking his head. "I'm sorry, George. I'm not going to deactivate myself."

"You prefer to see Dr. Ng die?"

Rathburn could shut off his visual input, the equivalent of closing his eyes. He did that just now for a moment, presumably much to the chagrin of the sharpshooter studying the datapad. "Believe me, George, the last thing I want to do is see anyone die."

He reactivated his eyes. He'd thought he'd been suitably ironic but, of course, the other him had the same mind. GR-7, perhaps suspecting that something was up, had moved Dr. Ng so that she was now standing between himself and the glass,

"Don't try anything funny," said the skin. "I've got nothing to lose."

Rathburn looked down on his former self—but only in the literal sense. He didn't want to see this . . . this man, this being, this thing, this entity, this whatever it was, hurt.

After all, even if the shed skin wasn't a person in the cold eyes of the law, he surely still remembered that time he'd—*they'd*—almost drowned swimming at the cottage, and mom pulling him to shore while his arms flailed in panic. And he remembered his first day at junior-high school, when a gang of grade nines had beaten him up as initiation. And he remembered the incredible shock and sadness when he'd come home from his weekend job at the hardware store and found dad slumped over in his easy chair, dead from a stroke.

And that biological him must remember all the good things, too: hitting that home run clear over the fence in grade eight, after all the members of the opposing team had moved in close; his first kiss, at a party, playing spin the bottle; and his first romantic kiss, with Dana, her studded tongue sliding into his mouth; that *perfect* day in the Bahamas, with the most gorgeous sunset he'd ever seen.

Yes, this other him wasn't just a backup, wasn't just a repository of data. He knew all the same things, *felt* all the same things, and—

The sharpshooter had crawled several meters along the floor of the observation gallery, trying to get a clean angle at GR-7. Out of the corner of his robotic vision—which was as sharp at the peripheries as it was in the center—Rathburn saw the sharpshooter tense his muscles, and then—

And then Burloak leaped up, swinging his rifle, and—

And to his astonishment, Rathburn found the words "Look out, George!" emitting from his robotic mouth at a greatly amplified volume.

And just as the words came out, Burloak fired, and the window exploded into a thousand shards, and GR-7 spun around, grabbing Dr. Ng, swinging her in between himself and the sharpshooter, and the bullet hit, drilling a hole through the woman's heart, and through the chest of the man behind her, and they both crumpled to the operating-room floor, and human blood flowed out of them, and the glass shards rained down upon them like robot tears.

And so, at last, there was no more ambiguity. There was only one George Rathburn—a single iteration of the consciousness that had first bloomed some forty-five years ago, now executing as code in the nano-gel inside a robotic form.

George suspected that Shiozaki would try to cover up what had occurred back in Paradise Valley—at least the details. He'd have to admit that Dr. Ng had been killed by a skin, but doubtless Shiozaki would want to gloss over Rathburn's warning shout. After all, it would be bad for business if those about to shed got wind of the fact that the new versions still had empathy for the old ones.

But Detective Lucerne and his sharpshooter would want just the opposite: only by citing the robotic Rathburn's interference could they exonerate the sharpshooter from accidentally shooting the hostage.

But nothing could exonerate GR-7 from what he'd done, swinging that poor, frightened woman in front of himself as a shield . . .

Rathburn sat down in his country house's living room. Despite his robotic body, he did feel weary—bone-weary—and needed the support of the chair.

He'd done the right thing, even if GR-7 hadn't; he knew that. Any other choice by him would have been devastating not just for himself, but also for Kathryn and every other uploaded consciousness. There really had been no alternative.

Immortality is grand. Immortality is great. As long as you have a clear conscience, that is. As long as you're not tortured by doubt, racked by depression, overcome with guilt.

That poor woman, Dr. Ng. She'd done nothing wrong, nothing at all.

And now she was dead.

And he—a version of him—had caused her to be killed.

GR-7's words replayed in Rathburn's memory. *We'd just never been in such desperate circumstances before.*

Perhaps that was true. But he was in desperate circumstances now.

And he'd found himself contemplating actions he never would have considered possible for him before.

That poor woman. That poor dead woman . . .

It wasn't just GR-7's fault. It was *his* fault. Her death was a direct consequence of him wanting to live forever.

And he'd have to live with the guilt of that forever.

Unless . . .

Desperate circumstances make one do desperate things.

He picked up the magnetic pistol—astonishing what things you could buy online these days. A proximity blast from it would destroy all recordings in nano-gel.

George Rathburn looked at the pistol, at its shiny, hard exterior.

And he placed the emitter against the side of his stainless-steel skull, and, after a few moments of hesitation, his golden robotic finger contracted against the trigger.

What better way, after all, was there to prove that he was still human? ■

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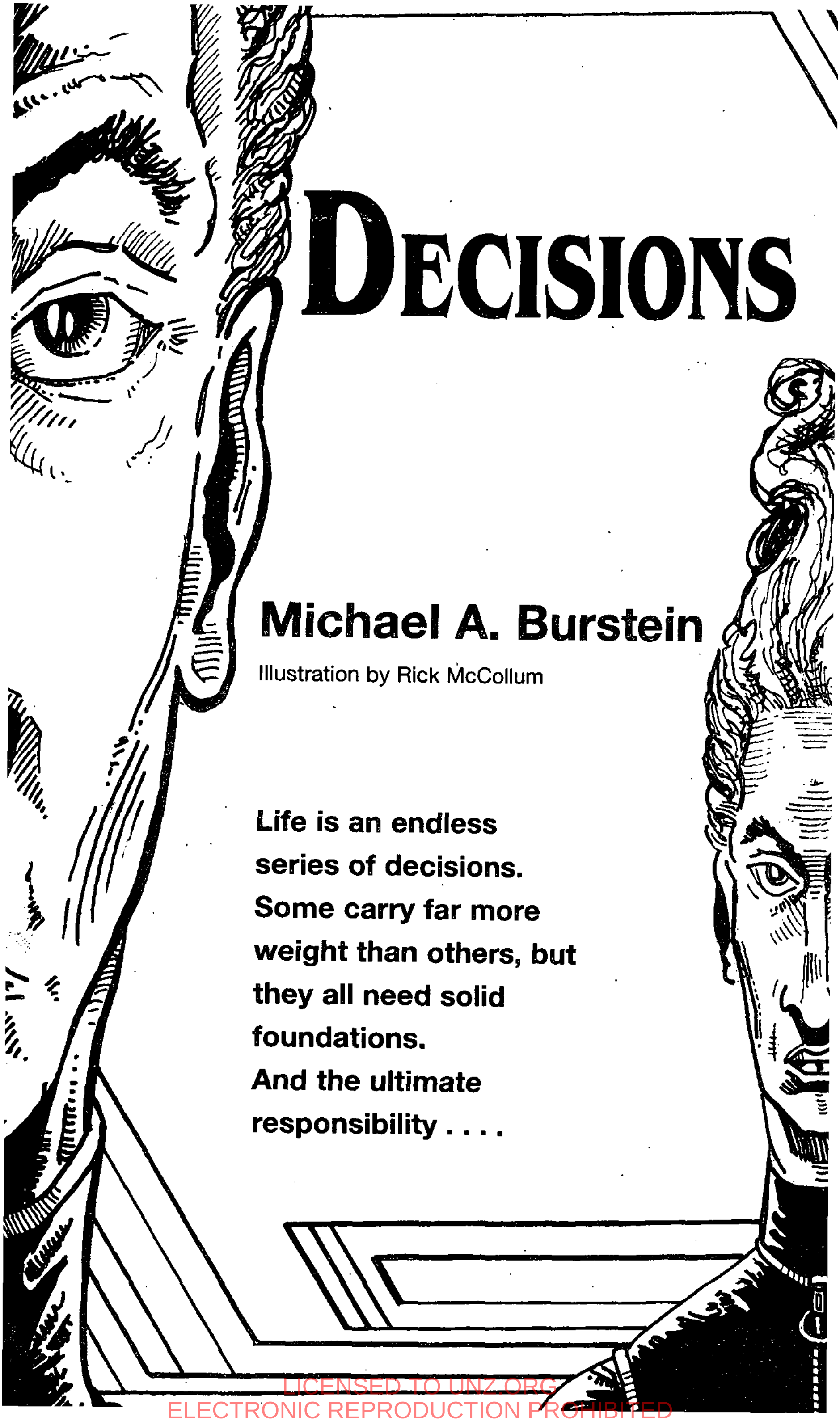


DECISIONS

Michael A. Burstein

Illustration by Rick McCollum

**Life is an endless
series of decisions.
Some carry far more
weight than others, but
they all need solid
foundations.
And the ultimate
responsibility . . . .**

Commander Aaron Eliassen threw the tray across his cell. It smashed against the far wall, covering the white molded plaster in a mix of browns, greens, and reds. The tray slid down to the floor, clattered for a moment, then fell still.

Aaron glared around the small, featureless white room at nothing in particular. For the twentieth time, or the hundredth, or perhaps the thousandth, he ran and smashed himself against the locked door, hoping that perhaps this time he would break apart the unseen hinges.

As before, the door refused to budge. All he succeeded in doing was getting his blue jumpsuit even filthier than before.

Aaron placed his eye against the crack between the door and the wall, again trying to peer through to the outside, to get some idea of what lay beyond. He tilted and twisted his head to get some sort of view, but all in vain.

He shuffled back from the door until he stood in the center of the room, then looked up at the ceiling. Although he had not yet spotted a microphone or surveillance camera, he assumed he was being monitored. "You hear me?" he shouted. He pointed at the mess of food that lay in a lump on the floor. "Did you see that? I'm not going to eat anymore. Not until I get some answers."

No one responded. Eliassen walked over to the discolored wall and stared at the gloppy mess of stew, asparagus, and gelatin. His stomach rumbled slightly, but he ignored it.

"Let me out!" he screamed. He beat against the door with both his fists in unison, and then when that got tiring he changed the rhythm. Right fist, left fist, right fist, left fist. He walked around the perimeter of the room, continuing to bang against the wall, until he had come back to the door and his hands felt raw. He dropped his arms to his sides, panting. How many times had he done this? He couldn't say. He couldn't remember.

"Talk to me," he said between breaths. "Someone, anyone, talk to me. Please."

He walked over to the bunk, stared at it, and then, in defiance, he collapsed onto the floor. For the third or fourth time, he cried himself to sleep.

Aaron heard the voice, a deep one, calling his name. "Commander Eliassen. Commander Eliassen. Please wake up."

Aaron opened his eyes and immediately shielded his face with his arm. A bright light shone through the open—finally, open!—door. A figure stood in the doorway, with the light forming an aura around it.

Aaron fought down an urge to jump up and run through the door, knowing it would get him nowhere. Instead, he eased himself up, barely noticing that although he had fallen asleep on the floor, somehow he had ended up in the bunk. "Who is that?" he rasped.

The figure nodded to someone outside, and the door clicked shut, once again blending into the wall with but a tiny crack around it. Aaron's eyes adjusted to the ambient fluorescent light. He glanced at the far wall; someone had cleaned all of the food off of it, but a nauseating spot of brown color remained on the floor.

"Do you recognize me?" the figure asked.

Aaron studied the man's face and body for a moment. Black hair, solid jaw, etched wrinkles, blue blazer—it could not be possible, and yet Aaron did recognize the man.

"Director Carter?" he asked softly. "Gabe?"

Gabe nodded, his lips pressed together tightly.

Aaron jumped out of the bed and ran towards his friend, a mixture of anger, fear, and relief playing out within him. He raised his arms, but whether he intended to hug Gabe or choke him, even Aaron could not say. He figured he'd decide once within range.

Before he could get too close, however, Gabe pulled a revolver out of a shoulder holster and pointed it straight at him. Aaron stopped short. He lifted his gaze from the gun and stared into Gabe's eyes, trying to read his friend's blank expression.

"Gabe?" he said again. "Is it really you?"

Gabe nodded once. "Yes, Aaron, it's me. Please do not come any closer." His voice sounded cold but uncertain.

"I don't understand," Aaron said.

Gabe held the gun steady. "If you get violent, I will shoot you. If that doesn't stop you, the soldiers standing outside will fill the room with gas and knock us both out."

Aaron nodded. He backed away from Gabe with measured steps and sat on the bunk. "May I ask a question?"

Gabe slid the revolver back into its holster, but kept his eyes on Aaron the whole time. "Go ahead."

"What the hell's going on here?"

Gabe looked around the room for a moment. When his eyes finally settled on Aaron's face, Aaron noticed that they were bloodshot. "Perhaps you can tell me," Gabe said.

Aaron's jaw dropped. "*I* should tell *you?*"

Gabe nodded. "Yes. Tell me everything that happened after you returned from your mission."

"After I returned? But the mission itself—I need to tell you about my discoveries—"

"Don't!" Gabe shouted, holding up both his hands. "Only tell me about everything that happened to you since you landed."

Aaron's anger had disappeared into his confusion; it now returned stronger than before. He repressed an urge to spit. "Don't you already know? Look around you!"

Gabe made no move to turn his head, so Aaron continued. "You locked me in a cell. You must know this already. Why are you torturing me?"

Gabe shook his head so slightly that Aaron could barely see it. "Assume I don't know already. Assume I need to hear it from you. From the instant you made contact with Earth."

Aaron yawned, cracking his jaw. "Well. The instant I made contact, hmm? Houston told me to bring her in at Edwards instead of the Cape. I came in fine, a perfect two-pointer."

"And then?"

Aaron glowered. "And then a bunch of army soldiers grabbed me out of the shuttle and dragged me into this cell. No one listened to my protestations or questions; it's as if I spoke Martian."

"And what have you done since?"

"Done?" Aaron made no effort to hide the sarcasm in his voice. "Why, I took in a show and made out with a dancing girl. I'm planning to introduce her to Mom next week." He tensed up. "What in God's name do you think I've done?"

"I'm sorry. It was necessary."

"Necessary? It was necessary for NASA to treat me like a common criminal? No—worse than a common criminal. No television, no radio, no Internet access—not even a telephone to call a lawyer, let alone my mom. Is this still America or what?"

Gabe lowered his eyes. "It's still America."

"How long have I been here? Counting the meals pushed through the slot and the cycle of the lights, I'm guessing four days."

"Four days sounds about right."

"'Sounds about right?' Don't you know?"

Gabe placed his hand on his chest, near the holster. "Aaron, what's the date?"

"Huh?"

"You remember your mission schedule?"

"Of course I do."

"Well, then. If we assume that you landed four days ago, and have been here ever since, then what's today's date?"

Aaron thought for a moment. "If I returned on October tenth, as scheduled, then today's October fourteenth."

Gabe sighed. "It's not."

"It's not?"

"No. It's May eleventh."

Aaron narrowed his eyes. "Are you telling me I was in space for over a year? Impossible. I didn't have enough supplies to last for that long."

"You misunderstood me. Today's May eleventh, a week before your launch."

That evening, still locked in his cell and eating bland food off one of the government-issued trays, Aaron went over the conversation from that afternoon. At first, he had refused to accept his old friend's statement.

"What are you talking about?" he had asked.

Gabe sighed, and slid down with his back against the wall next to the door. He crouched on the floor, looking ready to jump up if Aaron made any sudden moves. "What I mean is," he said, drawing each word out, "you haven't left yet."

"Bullshit! I've gone and returned." He stood up from the bunk and pointed at himself. "See? Here I am."

Gabe appeared to tense up. "Oh, I can't argue with the fact that you've returned, Aaron," he said, waving a hand. "I mean, I'm talking to you right now."

Aaron settled onto the bunk again. "Well, then?"

"Well, then." Gabe sighed. "The thing of it is, I also talked to you this morning."

"This morning? No way. I would have remembered." Even though, Aaron thought, he had no way of knowing the time, since no clock hung in the cell.

Gabe chuckled. "I'm sure you do remember the conversation. I spoke with the real—I mean, the one of you who hasn't left yet."

"And what did we discuss?"

"We talked about the wafer with all the names on it." Gabe stared at his face. "You said—"

"I said that it was a waste of my weight allowance."

"Yes."

Aaron snorted. "I remember that conversation. From over six months ago."

Gabe shook his head. "It happened this morning."

Aaron leaned forward. "Prove it to me."

Gabe stood up again and held out his arms in a gesture of helplessness. "I wish I could."

"Not good enough. If this is for real, then tell me—how did I travel back in time?"

"We believe your ship followed a Gott closed timelike curve, if you know what that means."

Aaron shook his head. "I don't."

"Do you want me to try to explain it to you?"

Aaron smiled. "I wouldn't consider it proof."

Gabe put his fingers together and stared at the wall over Aaron's head. "Think about my dilemma for a moment, even if you consider it just a theoretical exercise. How could I prove to you that you're in the past? You've lived through it already. There's nothing I can show you that you haven't already seen." He paused. "I suppose you could ask me questions to try to trip me up, but I don't see how that would work."

A sudden realization hit Aaron. "But I could prove to you I'm from the future, is that it? Tell you what's going to happen tomorrow?"

The color drained from Gabe's face. "No," he said, "do not do that, under any circumstances."

"Why not?" Aaron looked around at the walls. "Isn't that why you locked me in here?"

"No. We locked you in here to avoid any paradoxes."

"Paradoxes?"

Gabe sighed. "Aaron, what would you do if you managed to build a time machine? What would you use it for?"

Aaron's nose itched; he scratched it. "You tell me."

"You might use it to give yourself information about the future, so as to change it. But if you change it, then where did the information come from in the first place?"

Aaron thought for a moment. "I've heard of this. The Grandfather Paradox, right? I go back in time and kill my grandfather, and then I was never born. But then how did I go back in time if I never existed?"

Gabe nodded, a small smile on his face. "Good. You do understand."

Exasperated, Aaron asked, "*What* do I understand? Tell me."

"You understand why we had to lock you up."

Aaron glared at Gabe and clenched his fists. He suppressed the rage he felt. "I do not understand that at all," he said in measured tones.

"We had to keep you away from everyone else to avoid contaminating the present with information from the future."

Aaron grunted. "I suppose," he said, "I could grant that necessity."

Gabe sighed. "I'm glad you can see it my way. My own presence here is a risk. If you told me something about the future, it could destroy the Universe."

Aaron stared at his friend for a moment, then laughed. The hollow laughter rippled and cascaded, and wouldn't stop. After a moment, Aaron began coughing.

"Are you okay, Aaron?"

Aaron waved his friend's concern away as the last of his coughs spasmed out. "Yeah, I'm fine. It's just that you sounded so melodramatic." He mimicked Gabe's serious tone. "'It could destroy the Universe,'" he repeated, and he started laughing again.

"It could."

Aaron stopped laughing. "Literally?"

"Yes."

Aaron thought for a moment. If Gabe was telling the truth . . . "Then coming in here to see me must be some risk."

Gabe shrugged. "You weren't doing too well, Aaron. Somebody had to explain."

Aaron looked into Gabe's eyes and realized that Gabe himself must have fought for the right to tell Aaron why they had locked him away. For a moment, Aaron felt affection for his friend. But it quickly faded. After all, Gabe might have fought to talk to him, but what Aaron really wanted, really needed—

"Let me go, Gabe."

"I can't. It'll create paradoxes. We need to avoid them."

"You *can't* avoid any paradoxes! Hasn't my presence here already affected the timeline, if you believe your nonsense?"

Gabe smiled. "And now you understand my problem, old friend. According to Doctor—I mean, according to our physicists, I have to minimize your impact here as much as possible."

Aaron shook his head. "The only way you could do that is by keeping me locked away in here until the time comes for me to return."

Gabe stared at him silently for a few seconds, and Aaron suddenly felt cold.

"No," he said. "No way. You can't possibly—"

"What choice do I have?"

Aaron's mind raced through the possibilities. "You've got a million of them! If you believe this crap, just let me out after the shuttle leaves on May eighteenth."

"No good," Gabe said. "We can't explain your quick return. We're going to have to keep you here until October, without any other human contact. But I will push for a TV for you. Think of it this way. It will let you catch up with everything you missed, in real time." He paused. "I'm sorry."

The door clicked open, and Gabe dashed through it. Aaron had rushed him, screaming, but by the time he got to the door, it had shut tightly in front of him.

And now, as he finished his food and left the tray on the floor, Aaron considered his options. He refused to stay locked up, without human contact, for six months. What could he do? He had to escape, somehow. But how? The door remained locked at all times, and his incessant tapping and banging on the walls had revealed no hollowness anywhere around.

Then he realized something. He had never been awake for the delivery of the food. They had to get it into and out of the room somehow . . .

Aaron smiled. Yawning loudly and deliberately, he walked over to the bunk and lay down. He closed his eyes, fought to stay awake, and waited as if he had all the time in the world. When the door finally clicked open, he was ready.

Only one guard came in to retrieve the tray while Aaron slept. Only one, probably to reduce "contamination" from the future, as Gabe had put it. A lucky break, but Aaron had managed to surprise him. The guard now lay unconscious in the cell as Aaron dashed through the corridors of the base, wondering where he could run to.

As Aaron ran, a feeling of familiarity snuck up on him. He knew the base, he knew it intimately, and this place looked very much like the way he remembered it.

He stopped. Could he really have traveled into the past? Was today really May eleventh—perhaps now May twelfth?

If it really was a week before he launched, then Aaron—his earlier self—would still be here in California, doing some last minute prep work before flying to Florida. They kept him at the base, going over the details of the mission, checking his health, and generally giving him busywork until the time came to leave.

Aaron had nowhere else to run to, and an idea had already begun forming in his mind. Quickly, he navigated his way to his old quarters, in the residential part of the base. He found his door and jimmied it open, glad to see that he still had the lock picking skills he had taught himself in college.

The door opened onto a dark room, with the ambient light of the corridor illuminating the nondescript bed, desk, computer, and chair. He snuck into the room, closed the door gently behind him, and flipped on the light switch. The man lying on the bed groaned and moved an arm to cover his eyes.

Aaron strode over to him, shook the man awake, and found himself face to face with—himself. Despite his expecting this on an intellectual level, his breath still caught in his throat.

The other Aaron's eyes filled with fear. He opened his mouth, and Aaron quickly placed his hand over it. God, this felt weird.

"Aaron, don't shout, don't scream. I need to talk to you. Please relax. I'm not going to hurt you." He paused. "Do you understand?"

The other Aaron nodded, although fear still showed in his eyes. Slowly, Aaron removed his hand.

"How are you?" he asked.

The other Aaron sat up in his bed and pulled his body back into a defensive position. "What the hell's going on? How did you get in here?"

"Take a good look at me, Aaron. I'm you."

Aaron waited while his younger self studied his features. Finally, the younger Aaron said, "This isn't possible."

"That's what I've been trying to tell Gabe. Apparently, when you—when I—went on the deep space mission, we followed some sort of closed something something loop. I ended up back here, in the past."

"How is this possible?"

Aaron shook his head. "I can only think of one thing, and I tried to tell Gabe, but he wouldn't listen." He sat down next to his younger self. "Halfway through the mission, at the edge of the solar system, I found something, a colorful wall of light. I didn't discover it until I hit it, but it must have been that closed something something curve Gabe told me about. When I passed through it, I must have traveled back in time."

The younger Aaron scrunched his eyes closed and shook his head. "I'm dreaming."

"I wish. For a while I thought I was. But apparently, it's all real. I must really have traveled into the past." He looked off to the side. "Except—except that I don't remember this conversation."

"What?" his other self asked.

Aaron laughed as something occurred to him. "Listen, you. If I had traveled back in time, and met my past self—meaning you—shouldn't my future self—meaning me—remember this conversation? Wouldn't I be forming new memories for every second of this conversation?"

The other Aaron shook his head. "I don't know. I don't know what's going on."

Aaron shrugged. "Well, I don't know much of the science of time travel either. But it seems pretty likely to me. And that means that I'm not in the past."

"So where—I mean when—I mean, what's going on?"

"Stop babbling," Aaron said. "It makes you—me—look like an idiot." He sighed. "Now I don't know what's going on. Maybe the anomaly thrust me into a parallel universe, similar to mine but a few months out of sync. Perhaps if I search around, I'll find something different, a clue that I really have jumped universes. Or maybe—" He cut off, thinking.

"Yes?"

"I don't know. But I know this much—I'm not in the past. And I didn't even have to kill my grandfather to prove it." He grinned at his other self. "Or you."

The younger Aaron suddenly jumped out of the bed and lunged towards the desk.

Oh, shit, Aaron thought. He's going for my gun.

Aaron lurched at his younger self, his right shoulder aiming directly at the other man's chest. The younger Aaron went down, bent over and panting to get his breath back.

"No, I'm not going to kill you," Aaron said. "But I'm not going to be able to convince Gabe to free me either. Unless—" He walked over to the desk, opened the top drawer, and pulled out the gun. He pointed it at Aaron and said, "When you get your breath back, take off your clothes. We're switching places."

Despite his conviction that he had fallen into a parallel universe rather than the past, Aaron's life for the week before the launch followed an eerily familiar track. He couldn't possibly remember every single detail of his life from six months ago, but nothing happened that seemed out of place. He finished his training, flew to Florida, boarded the DSS, and launched.

And, halfway into the mission, Aaron found himself back at the anomaly, the weird colorful, curving wall of light he had encountered just outside the orbit of the Pluto-Charon system, which currently sat on the other side of the solar system. He remembered planning to tell Gabe about it just before Gabe told him not to reveal any details of the mission. Well, he thought, Gabe loses out.

It suddenly occurred to him that his escape, his approach here—both felt far too easy. Why didn't he remember this second, long trip to the outer solar system? Why couldn't he recall launching a second time either? What in God's name had happened to him?

He passed through the wall of light and found himself in empty darkness.

He opened his eyes and found himself back in his bunk in the cell. Two alien creatures stood in the room with him. They were tall and thin, with human-looking features that appeared stretched out, like in a funhouse mirror.

"Aaron Eliassen," one of them said in flatly accented English. "You were only partly correct. You did not go back in time, at least not directly. But neither did you fall into a parallel universe."

Slowly, Aaron eased himself out of the bunk. He kept his back to it and paced towards the wall. "Who are you?"

The aliens glanced at each other, and the smaller one spoke. Aaron couldn't differentiate between the voices. "Our name would mean little to you if we gave it in our language. Your species calls itself the Wise Ones; we call ourselves the Ones Who Speak."

Aaron looked back and forth between the two figures, and felt the urge to make a joke. "I'll call you Jabbers."

They looked at him without expression. "As you feel the need," the smaller one said.

"Do you have names?"

"Again, yes, but—"

"But I wouldn't be able to pronounce them or something. Fine." He pointed at each in turn, first the larger and then the smaller. "You're George and you're Gracie."

"As you feel—"

"—the need, yeah, I heard you the first time. So why did you tap into my mind and create that illusion for me?"

"You are quicker than we would have anticipated," Gracie said. "You have already figured out that we had a role in the creation of the illusion of your recent experience."

"Thank you, but I still want answers. What's going on?"

It hesitated, then said, "Did you ever wonder about first contact, Commander Eliassen?"

Aaron thought back to all the movies and TV shows he had seen about aliens. "Sure, who hasn't?"

"We represent an alliance of sentient beings. Whenever we discover a solar system in the process of developing intelligent life, we set up a special wormhole."

"The anomaly," Aaron said.

"Yes. We placed a boundary at the edge of your solar system, like a giant soap bubble. When you crossed it, it pulled you through a wormhole and transported you here."

Aaron quelled his fears by dwelling on the mundane. "Does that mean that the Pioneer and Voyager space probes were taken off course?"

"No. The system is designed to activate only in the event it detects an actual lifeform, not an artifact."

"Why?"

"Because only then do we know that a race has achieved the ability to colonize the galaxy."

Aaron stifled a laugh. "Humans are a far cry from colonizing the galaxy."

"Nevertheless, your race is at a beginning. And if we let you continue your explorations, you would soon discover wormhole travel and our alliance."

"We just have," Aaron said.

The aliens remained silent for a moment. Then the larger one took over the discussion. "Actually, you have that the wrong way around. *We* have discovered *you*. We needed to study your world. Our alliance needed to make sure that your species had developed to the point where you could accept our existence, become a part of our alliance. So we reached into your mind, let you think that you had returned to Earth, and let the scenario play out. So that we could understand your race as completely as possible."

The smaller alien said, "Unfortunately, your will was most resistant."

Aaron cocked his head at it. "What does that mean?"

"You were unwilling to create a present for yourself, so you replayed your experiences in the past, over and over, until finally your subconscious realized that you were trapped in a loop."

"I don't remember that."

"Of course you wouldn't. Your long-term memories have been recorded once; there was no need for them to code the same exact experiences again. So, instead, you broke out."

He looked around the cell. "How long have I been here?"

The aliens exchanged a glance. "On your scale, about a month."

"So I haven't been gone long enough to be missed. But you can't keep me here much longer."

"They will assume your mission has failed. Besides, soon it will not matter."

Aaron tensed up. "What do you mean, it won't matter?"

The two aliens remained silent, and Aaron felt cold. "Does this mean—you're not planning to destroy the Earth, are you?"

The aliens made a noise that Aaron couldn't understand, but it felt like laughter. "No, we do not destroy the incompatible emerging races. We simply lock them away."

"Lock them away?"

"The wormhole boundary becomes a barrier. Any living creature that enters it on one side of the solar system finds itself emerging on the other side of the solar system. A cosmic loop."

"A torus," Aaron said, drawing on memory of long-ago mathematics courses. "A four-dimensional donut."

"Exactly. We will lock your solar system into a toroidal shape, so you can never emerge to threaten the galaxy."

Aaron shook his head, and clasped his hands together to keep them from trembling. Still, he shivered. "If you lock us away, when the Sun dies, so will my entire race."

"But that is billions of years in your future. You personally will be long gone by then. It will not matter to you."

Aaron glared at it. "You haven't really learned much about humanity, have you?"

"We have learned enough. What we do may be regrettable, but it is necessary. Your race is too paranoid and violent to allow into the galaxy. You would threaten our alliance."

"We wouldn't," Aaron said softly. "On the contrary, we're not that paranoid."

The larger alien took over the conversation. "You cannot deny the paranoia that is inherent to your species. Your own people did lock you up when you returned before you had left."

Aaron felt a sudden need to respond to the alien's stupidity with his fists. But he knew that wouldn't help, and in fact, would just make things worse. He took a few deep breaths and then spoke in measured tones. "You know, it's really unfair for you to use a scenario that you yourself created to judge my species."

"Ah, but we did not actually create the scenario in its entirety, Commander Eliassen. We merely initiated it. Your own subconscious mind elaborated it, fleshed it out, and gave it reality. As we said before, we merely allowed the scenario to play out from the starting point. It was our way of learning more about your species, so we could judge you accordingly. And in the reality that you created for yourself, your own people locked you away."

"So they locked me away. Big deal. It was only because they were faced with something unexpected, something they had never seen before."

The aliens just stared silently at Aaron as the seconds passed. After a moment, he realized the implications of his comment, and he sighed. "Okay. I get it."

"Then we shall commence reshaping the space occupied by your solar system."

"Wait!" Aaron's mind raced with desperation. He knew he had to find an argument to ensure the future of the human race, and he reached for the only one that came to mind. "What if I offered you an alternative?"

The aliens gave him a quizzical glance. "Explain."

"Instead of locking us away forever, why not give us more time? Recreate your wormhole boundary twice as far away."

"What would that accomplish?"

"It would give us more time to develop, to mature." Aaron smiled. "The next human who comes this far might be years away. By then, we'll be less violent, less paranoid."

The alien gave him what appeared to be a sad look. "You cannot guarantee that."

"No," Aaron admitted. "I can't. But I can tell you this. We may be violent, but we aren't looking to enter space to conquer intelligent life. We're looking to befriend intelligent life, to work together in harmony." He resisted an impulse to fall to the floor and beg. Instead, he pulled himself a little taller and stared directly into the eyes of the larger alien. "I know you have the power to look into my mind. Do it again. Now. But look at everything it means to be human, not just the violent stuff that you're assuming is all there is."

"What do you expect us to find?"

"You'll see images of paranoia and fear, but also those of joy and hope. You'll see humans hurting each other, but you'll also see us helping each other. You'll see that we have the capacity for a higher morality."

"But why should we recreate the wormhole twice as far away? What is the point of delaying the inevitable?"

Aaron fought to stay calm. "That's just my point. It's not inevitable. We'll grow in that many years. And if we don't, so what? If we're still not acceptable to you, lock us off then. But give us more time, give us a chance. Please."

The aliens looked at each other. "Let us look into your mind, as you have offered."

Aaron nodded, and felt a sudden intrusion into his thoughts. His guts told him to resist, but his mind told him to let them see his life, his experiences, and his world.

Suddenly, Aaron no longer found himself with the aliens. He looked out into a bright light, and realized that he was watching the world from his own eyes at the moment of his birth. The world around him looked hazy, and people moved slowly around him. Then the world sped up, and Aaron became a detached observer in his own life. From a hidden corner of his mind, accompanied by the alien presences, he watched his life unfold. Elementary school, high school, college, the Air Force, his first kiss, the first time making love, the first time he flew solo, all the tragedies of his life, all the hopes, all his desires, all his dreams . . .

He blinked, and once more stood in the room with the aliens. They stared at him in silence. The seconds passed, and Aaron continued to wait while they continued staring. Finally, just when he thought he couldn't bear it any longer, the larger alien spoke. "Your proposal is acceptable."

Aaron breathed a sigh of relief. "Good." He paused. "So, I know you're giving the human race a second chance, but what happens to me now?"

"We will send you back, of course, after wiping your memory of our existence."

Aaron nodded. "I understand," he said. But, he thought, he would fight to keep his memory as intact as possible.

"Houston, this is Deep Space Shuttle One. Please reply. Over."

Gabe's voice came over the radio. "DSS One, this is Houston. How're you doing, Aaron?"

Aaron breathed a sigh of relief. "Much better, now that the lightspeed lag is gone. It's good to be back home. Over."

"Well, you're not quite home yet," came the amused reply. "We'll get you out of orbit as soon as we can." Gabe paused. "One thing, Aaron. Weather's a little stormy in Florida, so we'll need you to land at Edwards. Hope that's not a problem."

"No, not at—" Aaron began, and then something nagged at the back of Aaron's mind. "Um, Houston?"

"Yes?"

"What's today's date?"

"The date?" Gabe laughed. "It's October tenth. You've arrived home right on schedule."

"Good."

"Why, what did you expect? Relativity kicking in and bringing you far, far into the future? You never went fast enough for that."

"No, not that. I expected—" Aaron thought for a moment, but nothing came to mind. "I don't know what I expected."

"Well, you should expect a parade, at least. You'll be a genuine hero when you return. Just like Neil Armstrong."

Aaron leaned back and smiled. What does a hero do? He promotes causes, of course. And Aaron knew that it would be vitally important for him to use his new status to speak out against fear, against hate, against violence and wars. He couldn't say why. He just knew it had to be that way.

Their current job completed, the beings Aaron had called George and Gracie studied the naked bodies of thousands of other primitive aliens suspended in separate plasma baths, which kept them alive as they lived out their illusions.

The Younger asked the Elder, "Have you ever done such a thing before?"

"Never," the Elder replied. "Never in the history of our existence."

"Will you not get in trouble?"

"No. It is my decision to make, as it will be yours to make when I am gone."

"But to make such a promise to a primitive, violent alien, and then to carry it out."

The Elder's countenance took on the equivalent of a smile. "That very promise is the reason for our jobs. Have you never wondered why we do not just lock up every other solar system with the potential for intelligent life? Why are we here, to intercept each race as they emerge from their shells? What is our function?" He paused. "Do you now understand what you are being trained to do?"

The Younger thought for a moment. "I think I almost understand. Please make it clear for me."

"The humans," the Elder said. "They were the first to discover the secret."

"Which is what?"

"That it is not a race's capacity for violence that condemns us, but rather, the decisions that we choose to make. This human, Aaron Eliassen, made the right decision." The Elder swept his arm around, indicating all the aliens floating in their plasma baths. "Every other alien representative that we have encountered has always reacted the same way, claiming that they will conquer the Universe, and along with it, us. We had no choice but to lock their races away forever. But this human chose wisely. This was the first representative that expressed a different hope, that his race would one day be more acceptable to us, rather than requiring us to be more acceptable to them."

"I understand."

"Perhaps one day, they will be partners with us. For now, though—"

An ultraviolet light blinked on, and at the same time, a high-frequency whine began.

The Elder turned to the Younger. "Another race has emerged from its shell. Let us attend to it."

The Younger closed the door of the chamber behind it, pausing only briefly to study the hundreds of aliens suspended in their plasma baths. He recalled how many in turn had threatened the Elder with violence, and had claimed that their race alone would own the Universe. He had reached the beginning of understanding, and sorrow filled his being.

He turned to the Elder. "It is good that we could decide as we did for the human. But what a pity that we could not decide otherwise for the rest."

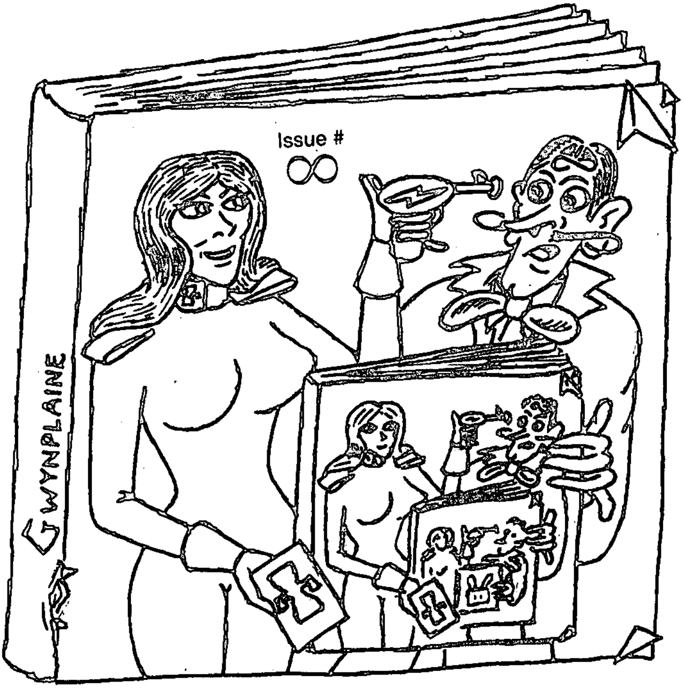
"They decided for themselves, young friend. We do not judge them; they chose their own verdicts." ■

ANNUAL ANNULAR ANNALS

F. Gwynplaine MacIntyre

Illustration by F. Gwynplaine MacIntyre

Just when you thought you were safe
from Smedley Faversham . . .


Issue #
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GWYNPLAINE

"This job takes all my time," said Officer Julie Anne Callender of the Paradox Patrol, as she unbelted her blaster pistol, kicked off her duty boots, sighed heavily, and sank wearily into a chair in the squad room of Paradox Central. Actually, there was no chair beneath her as Julie Anne sank wearily backwards, but she was spared the indignity of pratfalling her goddess-like posterior across the deckplates. This was because Paradox Central's squad room (a rather squalid squad room) is equipped with a utility fog of airborne nanotech microbots. The utility fog had been keenly monitoring Julie Anne's biorhythms, and calculating a 99.9 percent probability that she was about to sigh heavily and sink wearily (or sigh wearily and sink heavily) into empty air in a place where a chair was supposed to be, so now the utility fog dutifully wafted itself across the squad room and morphed its nanomass into the appropriate size, shape, color and density to replicate a comfy overstuffed air-chair . . . just in time to catch Julie Anne's delectable derriere in midair, supporting her weight with ergonomic efficiency. A subgroup of utility foglets were speedily morphing into an automatic ottoman which was scientifically designed to support Julie Anne's feet while gently wicking away the perspiration accumulated on her tootsies during her arduous tour of duty. Normally, the nanotech furniture in Paradox Central's squad room is programmed to thriftily recycle the sweat and other excess bio-fluids of Paradox Patrol officers (the squalid squad room does not squander its squalor) . . . but the auto-ottoman contained an algorithmic subroutine which diverted all the perspiration from Julie Anne Callender's voluptuous feet for delivery to an auction site on eBay.

"This job takes *all* my time," she repeated to nobody in particular, and the statement was literally true. During the past eight-hour shift, chrono-constable Julie Anne Callender had prevented the assassination of Calvin Coolidge in 1927, saved Benjamin Franklin from fatal electrocution during his kite-flying experiment in 1752, nabbed a gang of far-future fraudsters who had conspired to wreak economic chaos in the year 2874 by flooding the antiquities market with counterfeit Rush Limbaugh lunchboxes, and—oh, yes—in the midst of her coffee break, Officer Callender had foiled an invasion of Earth by bloodsucking aliens in the year 457 B.C. during the Peloponnesian Wars. (If your history textdisk neglects to mention that Earth was invaded by bloodsucking aliens during the Peloponnesian Wars, that's because Officer Julie Anne Callender of the Paradox Patrol got there just in time to unhappen it. All in a day's work.)

The gentle reader might wonder how Julie Anne could accomplish so many deeds in a single eight-hour duty shift, and the answer is . . . she could *not*. The aforementioned tasks required nearly three days' worth of Julie Anne's undivided attention. But the Paradox Patrol was currently undergoing its annual staff evaluations, and so Julie Anne had decided to tweak her efficiency rating by warping her personal timeline so that some off-duty hours from her future (weekends and vacation days) were spliced between the departure and arrival points of her on-duty constabulary trajectories in space-time . . . so that she experienced three days' worth of her lifetime while the duty sheets showed she'd only worked an eight-hour shift. In those eight hours, she had quite literally aged three days.

"This job takes *all* my time!" Julie Anne moaned again, and the nanotech air-chair nodded sympathetically beneath her. "There's just one thing I'm grateful for," Julie Anne tiraded spleenfully. "It's been a while since I've had to go after that cheap crook Smedley Faversham, the intergalactic time-smuggler and proverbial no-good-nik. Him and his lousy puns! Faversham's been awfully quiet lately, and good riddance." Julie

Anne sighed contentedly and sank deeper into the armchair. "With that chronogoniff Smedley Faversham out of my continuum, I can finally get some peace and . . . *uh-oh.*"

Officer Callender's reverie had been interrupted by the sudden arrival of a small wormhole directly in front of her. The wormhole's circular event horizon was spangled with a rim of glowing ion plasma which now contorted its shape so that the circular aperture of the wormhole twisted its midsection into a figure-eight. "Somebody wants me to report to Level Eight," said Julie Anne, reaching for her boots.

The wormhole rotated ninety degrees clockwise, shifting its figure-eight pattern into a sidelong double loop . . . the symbol of *Infinity*. "Oh, time-warps and tesseracts!" said Julie Anne angrily, buckling on her gizmo belt. "Not Infinity again! Any place except *there!"*

But there is no arguing with Infinity. Adjusting her badge, Julie Anne Callender strode out of the squad room and across the time-corridor to the waiting elevator. Its doors hissed open to receive her. She stepped within, and confronted a long vertical column of softly glowing buttons.

At Julie Anne's eye level was an elevator button bearing the numeral 1, for the first floor of Paradox Central's headquarters. Directly above this was a button bearing the numeral 2, for the second floor. And so forth, upwards, in an ascending sequence of whole numbers. The topmost button was, of course, marked with the symbol for Infinity. The elevator was able to contain an infinite number of buttons because the walls of the elevator at Paradox Central are negatively curved, and therefore the inside of the elevator is larger than the building that contains it. This is a very convenient arrangement for everyone except the elevator inspectors.

"Floor, please?" asked the elevator's voice-simulation circuit.

Julie Anne nodded towards the uppermost button. "All the way to the top," she replied. "Take me to Suite Infinity."

After a brief elevator ride to Infinity, the doors hissed open at the top floor and Julie Anne stepped out . . . into Infinity's waiting-room. She took a seat: not in a high-tech nano-generated airchair this time, but on an ordinary vinyl couch (even Infinity has its limits). Seated on either side of Julie Anne were two guys reading newspapers and wearing T-shirts: the fellow at one end of the waiting-room wore a T-shirt emblazoned with the word *"Godot"* while the other fellow's T-shirt was captioned with the phrase *"the Robert E. Lee."* Looking for something to read while she waited for her appointment with Infinity, Julie Anne examined the magazine rack.

It is, of course, one of the laws of the Universe that all waiting-rooms are equipped with a supply of old magazines. The waiting-room at Suite Infinity, being infinite, contains every magazine that has ever been published in the past, present and future. Julie Anne put her goddess-like fingers into the magazine rack, stirred its contents randomly, and withdrew an old comic book with a bright red cover. In one corner of the comic book's front cover was a bright yellow Infinity symbol. No; turning the sideways comic-book ninety degrees to rightside it, Julie Anne saw that the yellow symbol was actually a numeral eight. To be specific: this ancient comic book was *Batman* issue Number 8, cover-dated January 1942.

The cover of the comic book displayed a colorful drawing of two strangely-costumed figures. Julie Anne's time-cop training required her to be well-versed in the cultures of many centuries, so she recognized these caped weirdos as Batman and his prepubescent underling Robin the Boy Wonder. The cover of *Batman* #8 (January '42) depicted Batman and Robin grinning broadly while they each used one gloved hand to hold the covers of a comic book, which they were reading. The comic book in their hands was *Batman* #8 (January '42), and its front cover clearly depicted a smaller version of Batman and Robin holding a comic book, which was a smaller version of *Batman* #8 (January '42). On the cover of *that* comic book was a smaller version of Batman and Robin, and *they* were holding in their hands an even smaller version of *Batman* #8 (January '42), which contained on its cover an even smaller version of Batman and Robin, who were holding . . . and so on down, dwindling into the micro-realm.

"This violates the laws of quantum space," said Julie Anne, glumly surveying the comic book's cover artwork, with its endless image of infinitely decreasing Batmans and Robins. "The pictures in comic books are actually little dots of colored ink which remain constant in size, and are therefore the quantum unit of all comic-book pictures. When the picture of Batman and Robin gets smaller than one quantum of comic-book ink, they can't . . . oh, is that for me?"

A buzzer had buzzed, summoning Julie Anne to the inner sanctum of Suite Infinity. She put down the comic book and stepped through a doorway which had materialized in midair directly in front of her . . . so that she could report to her most senior officer. For the person who dwelt in Suite Infinity was the highest-ranking administrator in the entire network of chronospatial guardians who proudly wear the badge of the Paradox Patrol. Here was the most uncorruptible cop of them all: the one known as . . . the Timekeeper.

Julie Anne Callender gulped nervously, allowing her eyes to adjust to the dimness in this room. Directly in front of her, she could barely perceive a cloaked and hooded figure, clutching a glittering scythe in one skeletal hand and an hourglass in the other: each grain of sand symbolizing a quantum increment of Time itself. Some of the grains of sand in the hourglass were flowing from the upper portion of the hourglass to the lower, while other grains of sand were flowing in the opposite direction, from the lower portion to the upper. Some grains of sand existed in the upper and lower portions of the hourglass simultaneously, while still other grains of sand were in neither, or were entirely outside the hourglass . . . and some grains of sand were inside and outside the hourglass both at once. Anyone who comprehends the basic structure of Time will understand this.

The hooded figure of the Timekeeper waited silently, in near-total darkness. Somewhere in the dimly-lighted chamber of Infinity, Julie Anne could hear a faint remorseless sound: *tickticktickticktick* . . .

The hooded figure at the center of Infinity nodded slightly, and beckoned her to approach.

Julie Anne saluted. "Patrolwoman Callender, reporting for . . ."

The Timekeeper made a swift gesture, signifying that there was no need for Julie Anne to introduce herself. Then the Timekeeper beckoned again. In the dimness, Julie Anne perceived a time-monitor, its vidscreen glowing softly and its controls already set. She came forward, to see what image was depicted on the monitor's screen.

The time-monitor was scanning several consecutive years at the end of the twentieth century AD and the beginning of the twenty-first century. Casting an expert eye across these decades, Patrolwoman Callender at first saw nothing unusual: a few minor time-stream paradoxes, some trivial anomalies. But then: "Wait a minute. What's this?"

One entire band of the fabric of Time was almost totally eradicated. To be precise: one long consecutive segment of Time had been distorted and scarred nearly beyond recognition. In astonishment, Julie Anne saw that this damage zone corresponded almost precisely to one orbital period of the planet Earth:

365.24219 days. To be specific: the damaged segment of Time was exactly a year long, and it tallied precisely with Earth's calendar year 1999 AD.

"Something's fishy here," said Julie Anne. "There's been some kind of abnormal time-travel activity on New Year's Day at the beginning of the year 1999, and on New Year's Eve at the *end* of 1999, and it's wreaking havoc in space-time throughout the whole year in between. More than once. Many times, in fact. But the greatest damage to the time-stream is at the beginning and the end of that year, for some reason."

The hooded Timekeeper paused expectantly.

"I'd better investigate this," said Julie Anne.

The Timekeeper's cowled figure nodded.

"Wait another minute," said Julie Anne. "I seem to recall learning in one of my training classes about something going completely gazonko at the end of the year 1999. There was some author . . . I think his name was Sir Clark C. Arthur, or something like that . . . who predicted that the planet Earth would undergo some hideous fate at the last stroke of midnight 1999. Because all the clocks in all the computers would have to roll over to the year 2000, and they couldn't handle the zeros, or something."

The Timekeeper nodded.

"Yes, that was it," said Julie Anne. "Something to do with the end of the millennium. Only 2000 wasn't really the start of the new millennium, but most people in that time period thought it was. I think there was a similar panic precisely a thousand years earlier, when all the peasants in the Dark Ages thought the Universe would end at the stroke of midnight on the last day of the year 999."

The Timekeeper's head shook from side to side, signifying disagreement.

"Let me check that," said Julie Anne, resetting the time-monitor and accessing other information. "Oh, now I see it. Many data sources claim there was widespread panic on planet Earth at the end of year 999 and the beginning of the year 1000, but none of those sources can be traced any farther back in the time-stream than a manuscript written in 1765 by some guy named Voltaire. Apparently he wanted to convince his readers that people in earlier centuries were all superstitious idiots, so he just made up a story about a millennial panic, and later historians just assumed it was true . . . but it never happened. I learn something new every day in this business."

The Timekeeper made a questioning gesture.

"Well, I guess I'd better grease up a fresh wormhole and scurry yesterwards to 1999 AD, and find out what the hell is going on with all that time-distortion," said Julie Anne, checking her blaster pistol to make sure it was fully charged. "This shouldn't take long."

She retreated towards the outer portal, walking backwards rather than turning around . . . because she could not bring herself to turn her back on Infinity. After she had gone several paces, the Timekeeper's robes shifted, and a voice spoke in sepulchral tones:

"Close the door on your way out," the Timekeeper commanded. *"There's a draft in here."*

Patrolwoman Callender filled out all the paperwork to requisition a wormhole, and then she set course for the year 1999. The unauthorized space-time distortion was affecting the entire year's time-line, but the distortion was strongest at the beginning and the end of 1999. After due consideration, Julie Anne decided to set her yestercourse for an arrival point precisely one hour before midnight, Greenwich Mean Time, on New Year's Eve . . . the last hour of the year 1999.

"And that suggests an obvious spatial trajectory," said Julie Anne Callender, adjusting the parameters of the wormhole while she moved rapidly pastwards against the currents of the time-stream. "In that particular century, the most bacchanalian New Year's rituals were always held in Times Square, New York City . . . so that's where I'll start my investigation." Julie Anne patted her blaster pistol in its holster, and made sure the safety was off. "Too bad I didn't have time to requisition some clothing appropriate for the year 1999, so I could go undercover," she decided. "I'll just have to materialize in Times Square on New Year's Eve, wearing my Paradox Patrol uniform and carrying my blaster pistol, and just hope I blend in with the locals."

Up ahead, the skyscrapers and thoroughfares in the space-time vicinity of midtown Manhattan, New Year's Eve 1999, were beginning to materialize. "At least my most unfavorite space-time knucklehead Smedley Faversham isn't here in Times Square to make a dumb pun about *time-squared*, or something worse," said Patrolwoman Callender, preparing herself to step forth through the wormhole's event horizon. "Well, if I remember my history lessons, Times Square on New Year's Eve was always crowded with thousands of people, and New Year's Eve 1999 was even rowdier than usual, because most people mistakenly thought it was the last night of the millennium. So I guess I can expect plenty of . . ."

She stepped forth, into the last hour of that vanished year.

Silence. Stillness. Desolation. Times Square was deserted. No traffic sounds, no glowing advertisements. The giant electronic billboards hung silent and empty. No streetlights gleamed. Cars and trucks sat motionless, unoccupied. Silent darkness, alone.

In the sky overhead, the pale moon dangled in its crescent's last quarter, on the last night of the last year of the world.

"Hey!" said Julie Anne, switching on her wrist-beacon, and shining it through the dark. "According to the textdisks, there were several million people living in this city on the brink of the millennium. Where did everybody go?"

Then she found them. The residents of this place. Their *remains*.

On the pavement near Julie Anne's feet was a man's rumpled suit, containing a skeleton. Near this were a woman's heaped garments, likewise holding a skeleton. The she-skeleton's leg bones were grotesquely encased in pantyhose. All around this place were human artifacts: clothing, wristwatches, laptop computers. But no people. No corpses, no flesh. Only bones.

Near a rusting fire hydrant, something glittered: a dog's collar, still encircling the upper vertebrae of a canine skeleton. Nearby lay the outstretched skeleton of a boy, his lifeless skull wearing a baseball cap turned backwards. Pressed against one side of his skull, where the boy's ear had been, the skeleton's hand in a death-grip still clutched a boom-box radio . . .

Julie Anne shuddered. Using her micro-scanner, she examined some of the skeletons. Every fragment of soft tissue . . . flesh, muscle, organs . . . was *gone*. Only bones remained. Setting the dial to wide-scan, Julie Anne verified that all the millions of this city's accustomed occupants—men, women, children, cats, dogs, pigeons, rats—were exactly where they were supposed to be . . . but all that remained were their skeletons. The lower life-forms—insects, spiders, microspores, protozoa—had vanished entirely.

"This won't look good in my report," Julie Anne muttered.

She searched the city. Stores had been vandalized; thousands of them. Windows had been shattered, locks had been picked, alarm systems were bypassed. But there was a pattern to the thefts.

Only foodstuffs were taken. In grocery stores and supermarkets, Julie

Anne found that all the shelves were picked clean. Food wrappers were torn open, stripped of their contents. Cartons fell empty. Countless millions of emptied cans and drained bottles lay jumbled in heaps. Jewelry stores, bank vaults, repositories of wealth: all of these stood pristine and untouched. But all food, all drink . . . everything *edible* had vanished. Not one bean was left standing.

Near a ransacked supermarket, Julie Anne found a building with its doors ripped off its hinges. A sign identified this place as a pet shop. The place was filled with silent cages: empty, except for a few whitened bones. In one birdcage lay a heap of brightly-colored feathers. Glass fishtanks were cracked and empty. In the center of the pet shop was a barbecue grill, containing a thin dust of charcoal. The empty wrapper from a package of hamburger buns lay nearby, alongside a drained bottle bearing the label for a popular brand of Worcestershire sauce.

"I'm not sure I want to know what happened here," Julie Anne decided.

She returned to the wormhole, and warped her way through space-time to emerge a few seconds later in London: in Trafalgar Square, another location associated with New Year's revels. Here too she found death, with no corpses. All the bones, human and beast, were picked clean.

"I don't like this," said Patrolwoman Callender. "If every single person in the year 1999 is dead, I'll have to fill out a lot of paperwork."

And here too, the same pattern. In the Tower of London, the Crown Jewels were secure. The Bank of England slumbered unmolested. Yet at Tesco's and Sainsbury's and every other place where food or drink was purveyed, every container had been opened and its contents removed. The pubs of London were sucked dry of their contents, with not so much as a packet of pork scratchings left behind. All gone. In the Regents Park Zoo, the cages of the beasts contained nothing but bones. Ditto the aviaries and aquaria.

Julie Anne wormholed to another city, then another. The same. "Maybe in 1999 all the people abandoned the cities," she thought aloud. She set her wormhole's trajectory for a space-time nexus corresponding to the Amazon rain forest. It was gone. The forest canopy had vanished. Some beaver-like sentience had gnawed the trees down to their stumps, then uprooted the stumps and chewed the roots. The once-proud Amazon lay stagnant, with only a few skeletons of fish and lizards floating on the river's surface. Setting her scanner to wide-band, Julie Anne verified that all the oceans of the Earth were lifeless. Plankton, seaweed, every species . . . *gone*, or reduced to bare bones. The lifeless harbors were choked with whalebones, flensed and picked clean of flesh.

No forests remained, no green fields. No blade of grass. Across the face of the Earth, there were only empty cities and barren wasteland.

"Anybody home?" Julie Anne shouted, hoping someone would answer. Then, faintly, her scanner detected fading bio-signs. The readings came from deep within a ravine in central Africa, in the Serengeti Plain . . . in an ancient place called Olduvai Gorge.

One more time, Patrolwoman Callender stepped into the wormhole. Once again, she altered its trajectory. Once more, she stepped forth . . . into a place devoid of life. The cracked soil was brittle and turning to dust.

Ahead of Julie Anne in the darkness, in a thin sliver of moonlight, something moved. Some unknown predator squatted in the dark, gnawing a haunch of some dead beast.

Julie Anne adjusted the focus of her bio-scanner. The haunch's cellular structure matched the DNA patterns of the mammalian species *Connochaetes taurinus*, also known as wildebeest or gnu.

But how could this one animal have survived on a dead planet, with no ecosystem—no grass, no trees, no pollinating insects—to sustain it? Well, however the wildebeest *had* managed to survive, it was clearly dead *now:* a pile of well-gnawed gnu bones were heaped nearby, while the half-seen predator squatted in the darkness, masticating the last remnants of flesh from the wildebeest's haunch.

"You're under arrest," said Patrolwoman Callender, stepping forward and raising her wrist-beacon. "Whoever and *whatever* you are, I hereby charge you with killing and eating every single life-form in this entire segment of the time-stream. Stand up slowly, you chrono-cannibal, and turn around."

The predator stood, and turned. His face was withered with age, and incredibly old. A few wisps of graying hair garnished his doddering head. The dull glint in his eyes showed the burden of centuries. His ancient limbs trembled. And yet, beneath all those wrinkles, his face seemed familiar . . .

"Smedley Faversham!" said the time-cop Julie Anne Callender, reaching for her blaster pistol. "What the hell are you doing in 1999?"

"I'm waiting till the coast is clear," said the time-thief. There was dust in his voice. The last time that Patrolwoman Callender had crossed the time-path of Smedley Faversham, he had been young and vigorous. Yet now he seemed incredibly old. "I'm *hiding*," he creaked.

"Hiding?" asked Julie Anne. "From who? I mean, *whom?"* She corrected herself, then she uncorrected the correction. "No, damn it; I meant *who*. If you and I are the only people still alive on this entire planet, I won't worry about grammar. Who or what are you hiding from?"

"Arrest warrants," said Smedley Faversham. "Space-time subpoenas. Repo men from several dozen intersecting time-lines, trying to repossess my wormholes and seize my assets. I've made enemies throughout the Omniverse, everywhere and *everywhen*. Sheriffs and bailiffs from numerous interdimensional realms, and a loan shark named Vinnie. Chrono-collection agencies. They're all after me. I'm down to my last wormhole."

"Sounds like par for your course, Faversham," said Patrolwoman Callender. The man in front of her was thoroughly palsied with age, and clearly in no condition to offer resistance, so she put her blaster pistol back into its holster. "But why are you just sitting here? Why aren't you on the lam, making your usual getaway across all the dimensions of space-time?"

A tear glistened in Smedley Faversham's eye. "My wormhole's radius is narrowing," he said. "I can't generate enough momentum to reach any parallel time-lines. Along *this* time-line, I can't travel much farther than ten years into the past or the future . . ."

Julie Anne shrugged. "Even with a linear range of twenty years in both directions, along a single time-line, that's still a pretty wide area for you to hide in."

"You don't understand," said Smedley Faversham, with terror in his eyes. "They're closing in on me. All my enemies unseen. Time-cops you've never heard of, from alternate time-lines where the Paradox Patrol never existed. They got the time-magistrates to issue bench warrants, so I can be extradited from the year 1998, and from the year 1997 before that, and 1996, and so on yesterwards for a couple of centuries." Smedley Faversham licked his lips nervously. "And they're ahead of me too: I can be extradited from the year 2000, or from 2001, or 2002, and every year after that for a few centuries futurewards."

"Wait a minute," said Patrolwoman Callender. It was almost midnight now on New Year's Eve, and all around her in the skies above Olduvai Gorge the air was rippling with space-time distortions. *Something* was approaching from adjacent time-streams. "If you can't time-travel more than ten years away from *this* year, and all the adjacent decades are off-limits, then . . ."

"I'm stuck in 1999," said Smedley Faversham in a voice tinged with doom. "I don't know why the time-magistrates didn't issue arrest warrants and extradition papers for *this* year too, but they didn't. Must have been some kind of bureaucratic glitch; probably something to do with that Y2K scare that all the people in this segment of the time-line got so worked up about. Whatever. But 1999 is the only year I can't be extradited from, so I've got to *stay* in this year as long as I can. Forever."

"I think I'm starting to understand this," said Julie Anne. "You mean, when you get to the end of the year. . . ?"

"I start over," Smedley Faversham nodded, trembling in horror. All around him, the space-time distortions were becoming stronger. "I arrive at the very first nanosecond of the year, on January first, 1999. Then I lie low, while the time-stream moves the year along for 365 days . . . just my rotten luck, this isn't a leap year. As midnight approaches on New Year's Eve, I start my wormhole and keep the motor running, while the time-cops get ready to arrest me if I set foot inside the year 2000. On the last stroke of midnight, one jump ahead of the gendarmes, I make my getaway . . ."

". . . back to the start of 1999 again," said Julie Anne Callender.

Smedley Faversham buried his face in his hands, and wept. "This is definitely my least favorite year," said Smedley Faversham. "When you get back to your headquarters and write your report, tell your boss that this is my *annus horribilis* . . . and make sure you spell it with *two* N's."

"I can see where this is going," Julie Anne nodded. "After hiding in 1999 for a while, you got hungry, so you helped yourself to a meal. Then another. All time-travel paradoxes are subject to Bester's Law, so any changes you made to the time-line during your *first* trip through the year 1999 were still in effect during your second trip . . . and the paradox accumulates every time your trajectory returns to its point of origin. All the groceries you ate during your *first* trip through 1999 were missing when you came back around again. The *second* year's worth of groceries were missing the *third* time you came around. After you ate all the groceries that existed in the year 1999, you started on the crops. When the crops ran out, you killed all the . . ."

"They're only dead in *this* time-line," groaned Smedley Faversham. "Thanks to Bester's Law, any life-forms I kill and eat are only affected in *my* time-line, not in theirs. All those pussycats I cooked and ate in my trajectory through space-time are still scampering and purring and coughing up hairballs in their own time-lines. I fished the seas, ate all the plankton . . . but only in *this* time-line." Smedley's chin quivered with shame. "I even ate . . . heaven help me! When there was no food left on Earth, I was forced to eat . . . *all the holiday fruitcake."*

Julie Anne shuddered in revulsion. "But even if you pigged out and ate twelve meals a day, plus snacks . . . if you ate every single life-form on this planet, it must have taken . . ."

"It did," said Smedley Faversham. He reached for the dead wildebeest's tibia, snapped it in half, and used the broken end to mark an inscription in the dried lifeless clay of Olduvai Gorge. While Julie Anne watched, he drew a number approaching the trillions.

"You've been here *that* many years?" she incredulated. "No! It's impossible! Even for you! The aging process is independent of time travel. If you've lived through the year 1999 over and over, a billion times, then you'd be so old you'd . . ."

"Nanobots," croaked Smedley Faversham. "The first time I arrived in 1999, I had a few self-replicating nanobots in my trusty cummerbund. When I saw I

was going to be here a while, I programmed the nanobots to replicate my telomerase, and repair my DNA, and do all kinds of other stuff that would delay my aging process. Then I injected them into my bloodstream." Smedley Faversham chuckled mirthlessly, and spat out his last remaining tooth. "Of course, the energy requirements of the nanobots meant I had to boost my calorie intake, so I had to eat *more often*, so I used up the food supply *faster*, and . . ."

"A vicious circle, in several senses of the term." Julie Anne nodded. Now she could see wormholes opening, all around the edges of Olduvai Gorge. Inside these wormholes' event horizons, bailiffs and repo men from a vast assortment of time-lines, with appropriate clothing and firearms, were checking their timepieces and eagerly awaiting the final stroke of the year 1999. Several of them pantomimed to Julie Anne, gesturing that she should stall for time . . . detaining Smedley Faversham beyond the brink of 1999 and into the first nanoseconds of the year 2000, where the long arms of the time-laws could claim him.

Julie Anne Callender nodded at the half-eaten haunch of flesh at Smedley Faversham's feet. "I'm afraid to ask, but . . . how does the gnu fit into all this?" she asked him.

"The wildebeest? Well, after I'd consumed every life-form in the North and South American landmasses, plus Eurasia, it dawned on me I would have to find a renewable food source," Smedley told her. "I trapped this wildebeest. It tasted pretty good, so I downloaded some of my nanobots into its carcass. I've created an immortal wildebeest."

"Immortal?" Julie Anne glanced down at the gnawed remains of the gnu. "Erm, . . . Smedley, I'm pretty sure this wildebeest is dead."

"Only temporarily," said Smedley Faversham. "The nanobots in the gnu have rescripted their programming. Now they're gnanobots. Or gnunobots." He was wild-eyed and raving now. "For the last few centuries of endless 1999s, I've been completely alone on a lifeless Earth . . . with only this wildebeest for, um, *companionship*. I kill it, I cook it, I eat it. Over and over. While I'm chomping on the gnu's hindquarters, the nanobots in the bones of the forequarters are regenerating the flesh and soft tissues. While I'm eating the forequarters, the nanobots are regenerating the hindquarters. There's always half a gnu left over, while I'm gnoshing the other half. I've invented a whole gnu kind of new . . . no, the other way around. I don't care any more. I've had gnothing but gnu to chew for the past few millennia, and I'm getting a hunger for something gnu . . . I mean something *new* to eat." Smedley Faversham stared intently at Patrolwoman Callender's face, as if noticing her for the first time. "Say," he asked, "is that *strawberry lip gloss* you're wearing?"

"Instead of going in circles, why don't you go *straight?"* Julie Anne quickly changed the subject. "For starters, Smedley, you could do a useful service for chrono-navigators throughout the space-time continuum if you could plot this weird course you've been traveling. Do you realize you've invented a new space-time trajectory?"

Smedley Faversham stopped whimpering for a moment. "How do you figure that?"

Julie Anne tried to sketch a circle in midair with her fingers while she spoke, but the circle showed signs of becoming a sphere, and then a hypersphere. "Along the axis of Time, you've been traveling in a straight line . . . because you get older and acquire new experience every time you repeat the year 1999. But along the axis of Space, your path is much more complicated. Every time you reach New Year's Eve 1999, you return to the same location in physical space where Earth existed twelve months earlier. So you're traveling in a straight line that's also a circle."

"No, not a circle." Even though the impending arrival of the oncoming space-time gendarmes made it advisable for Smedley Faversham to vamoose, his ego and his scientific curiosity still kept him lingering here, discussing the fine points of his trajectory. "A circle has solid existence in two dimensions of space. My path in space-time is just the *rim* of a circle, with nothing in the center. Like a circle, but hollow." Smedley nodded. "It's more like a ring. Or, to use the scientific term, an *annulus*. An annulus through Time, with a circumference of precisely one year."

Julie Anne took out her notepad. "I'd better write this down. When I file my report, I'll call it the Annual Annular Annals."

Smedley Faversham glared at her. "You'd better spell-check that report very carefully," he said. "Better yet, you can *annul* the annals. You can stick this whole annual annulus in your . . ."

PING! At that instant, a pinpoint wormhole appeared in midair near Smedley Faversham's elbow, and began to widen its own aperture.

"Well, there's my automatic timer, reminding me that 1999 is almost over . . . and about to start again," said Smedley Faversham, as the wormhole grew larger. Very slightly ahead in the time-stream, Julie Anne could see the bailiffs and marshals and repo men lurking in the first few nanoseconds of the year 2000, hoping that Smedley Faversham's departure would be delayed just long enough for his time-line to intersect with theirs . . . .

"I know what's waiting for me at the other end," he told Julie Anne, while jerking his chin scornfully towards the throng of waiting time-cops. "When I step through the wormhole, into the first nanosecond at the *start* of the year on New Year's Day 1999, I'll be able to look back over my shoulder a few seconds into the past, and I'll see these same palookas lurking just behind me in the time-stream—in the last nano-second of 1998—with their noses pressed up against the edge of 1999, trying to reach me . . ."

And now Smedley Faversham's wormhole shifted its axis, so that it faced towards Julie Anne. Peering into the depths of the vortex, from this aperture here in the last moments of the year 1999, Julie Anne could see all the way through the full length of the outstretched wormhole to its far aperture at the other end. At that far end was the *beginning* of the year 1999 . . . and beyond this, waiting, was the near end of the wormhole again . . . with Smedley Faversham and Julie Anne herself at the wormhole's brink. She could see herself there, as if in a mirror. And behind herself was the wormhole again . . . and *through* that wormhole, at its far end, she could see herself and Smedley Faversham again . . . and *behind* them, the same wormhole. And so on. Forever. A straight line to Infinity, with no turnings.

"Well, I'd better take this with me, if I expect to get any lunch where I'm going," said Smedley Faversham, picking up the nanogenically-reconstructed wildebeest haunch, and slinging it across his shoulder. "Of course, the nanobots are beginning to degrade, so it's getting more difficult for me to recycle this piece of leftover gnu-meat every time 1999 starts all over again. Do you have any idea how many times I've eaten this same damned wildebeest?" He winked at Julie Anne, and—in these last few moments of the dying year—she thought she detected a glimpse of the Smedley Faversham of younger days. "I've got it down to a routine now," Smedley went on, hefting the haunch. "At twelve-month intervals, each time the old year 1999 rolls over at the stroke of midnight into the new year 1999, I have to ring in the old . . . and I *wring out the gnu*."

In their own nearby wormholes, several of the waiting sheriffs and repo men staggered back, moaning and gasping . . . either from the ghastly pun, or from the stench of the wildebeest. But now the very last nano-instant of 1999 drew nigh, and all the waiting time-cops brandished their weapons as they prepared to rush forward and arrest their quarry.

"Wait, Smedley!" said Patrolwoman Callender. "No matter what's happened, you can still make a useful contribution to scientific knowledge. If you could plot the space-time trajectory for this crazy caper of yours, Smedley, it might benefit chrono-navigators throughout the time-stream!"

Smedley Faversham paused at the edge of his wormhole. In the brink between years, as the old year 1999 was about to change into the new year 2000 AD, he cast a grim look at the hordes of sheriffs and time-cops who were just about to arrest him, while Julie Anne shouted her last desperate plea: "It's not too late, Smedley! Please, for the sake of science . . . *can you describe this space-time trajectory that forces you to repeat the same New Year's Day over and over in a never-ending cycle?"*

Smedley Faversham turned, and straightened, and defiantly flung the haunch of wildebeest at his pursuers.

Then he spoke: "It's an Auld Lang Sine Curve."

The cops closed in, flailing their truncheons . . . as he vanished. ■

IN TIMES TO COME

Stories about shapechangers have existed in science fiction for a long time, at least as far back as the classic "Who Goes There?," by John W. Campbell (writing as Don A. Stuart). And we know that shapechangers really exist—just ask any butterfly. The real ones we know are very slow and specialized—but might something like the traditional science-fictional form actually be achievable, in light of science we now know or may soon learn?

Beginning in our next issue (March), Joe Haldeman takes a thought-provokingly fresh look at that question in a new serial, *Camouflage*. This one is unusual, if not unique, in another respect as well: most science-fictional shapechangers have been seen from outside, by humans forced to deal with the threats they posed. *Camouflage* offers not one, but two shapechangers as major viewpoint characters, which makes for a decidedly novel story experience. Of course, if you think about what shapechanging involves, and the fact that these characters are at heart nonhuman, you'll realize that that will involve some scenes that may be a bit, shall we say, unnerving. But I think you'll find the ride intriguing, to say the least—and such an unusual ability carries with it the capacity for some special kinds of learning. . . .

In a distantly related vein, Kyle Kirkland offers a fact article on "Artificial Chromosomes for Gene Therapy and Designer Babies. Most of us are already familiar with research on creative recombination of existing genes, with various degrees of uneasiness about the likely applications. But whole artificial chromosomes? That stretches the possibilities a good deal farther, and we can't decide what to do about them unless we understand what they are. . . .

And, of course, we'll have the usual unpredictable mix of stories by such writers as Larry Niven, Grey Rollins, Jerry Oltion, and Richard A. Lovett.

The Dragon Wore Trousers

Bob Buckley

There are at least two sides to every story. . . .

It was a hot and sultry afternoon, a normal day, a perfect day. The ancient city should have been filled with the noisy clamor of everyday life, but its wide streets and majestically fluted stone towers and sweeping sky bridges were all hushed and deserted, an unnatural emptiness that shouted at the nerves. No clash of iron-bound wheels or scaled feet or talons tapping at worn cobbles half a millennium old came through the narrow windows of the cluttered workroom. There was only the soft chiming of the *calitor* as MakerOfWonders gave the inner channels of the light guide one final polish.

"There! Are you not beautiful?" he exclaimed proudly, holding the intricately shaped mass of gleaming quartz to the bars of sunlight streaming down from the arched ceiling. Prismatic rainbows danced on the water-clear curves, throwing colored highlights across the chiseled planes of his scaly face. Large, thoughtful eyes glowed from shadowed brow ridges. And truly, the glass sang. Light entering the strange turnings seemed to become confused, to twist frantically, growing ever brighter in agitation. Finally satisfied with his labors, Maker upended the light guide over a circular stone well set into the floor and gave it a shake. With a despairing cry, the tremulous wisp of sun glow slid from the maze of mirrored channels into the shaft and was consumed by velvety darkness.

Hissing contentedly through the gap of a broken tooth as wide and as long as a man's hand, Maker whirled grandly, his huge tail making the humid air hum with its passage, as he approached his latest, and perhaps final, creation.

As transparent as air, taller than SheWhoSpeaksLaw, his revered mate, the ThingThatRearrangesNowAndWhen was not something that could be easily seen. The transport cavity at its crystalline heart was so cramped that it could hold but one, and then only uncomfortably. But no matter, there was no one left to use it but Maker. Their feisty offspring were now encamped with their mother at the cold forests at the bottom of the world where darkness dwelled half the year. And the populace of the city, woeful fools, had scattered in a thousand directions to deluded safety: all the hunt masters, stone shapers, hide tanners, heavy haulers, meat strippers, keepers of herds, and, sadly, even the wisest of the preservers guild, all fled because of warnings from the great glass eye atop Thorntree mountain. The news had been dire, true, suggesting that all life would perish, even here, half a world away in fiery turmoil from the sky. If any survived, it would be at the distant southern climes. But the odds of salvation even there seemed dubious, doubtful enough to prompt Maker to try another way, a theoretical leap, sidewise, through time itself.

Maker did not miss the crowds. In his view, the city was vastly improved by its emptiness. And now, wrought in haste, through much trial and error, his curious device based on the latest discoveries in hard physics, and honed by just a pinch of black arts, was finally ready.

Bony hand trembling, Maker slid the light guide into its recess. Happily, it clicked into place perfectly within the base of the device. Immediately a harsh light began to pulsate. Now, the crystal could do much more than sing. Indeed, it hummed with power as its innermost facets began to glow.

Maker scurried frantically about the room, darting from table to table, the loose, tubular panels of the lab apron flapping against his muscular thighs. This handy utility garment was a sea of pockets which he stuffed full of gadgets and tools, anything that might conceivably prove useful during his exile. Then, something went SQUEAK! Startled by all the activity and disturbing of things long left untouched, a creature small and furry with a naked twist of pink tail sprang off the table to the floor. Maker hissed in annoyance. The hairy little pests were everywhere, it seemed, in the walls, under the floor, scurrying about in trees. Angrily, he trod on the squirming thing as it darted between his feet. Then, for just a moment, Maker paused, overcome by sudden sentimentality for his doomed world. He stood in silent reflection, drinking in the scents of the cypress and pines that surrounded the garden, admiring the play of light on clumps of shiny green cycadales, enjoying one last time the caress of the warm wind off the island-studded sea.

This quiet moment was interrupted as a handful of small meteors streamed green fire across the sky. Thunder chased their wake. Maker's huge mouth parted in an angry roar at the injustice of it all, a world, his whole civilization, slaughtered by a rock from the sky! It was simply not fair!

The meteors were warning enough. It was time to depart. Nostalgia was pure foolishness, an unprofitable emotion. Groaning, Maker folded himself into the heart of his device, forcing long legs and stiff tail into postures they were never designed for. His huge, crested head went up into the sensory receptacle. At once, his mind took control of the crystal. Energies were focused, contained in countless convoluted chambers, poised to loose pent-up strength. But to where? The past? He had already lived that, it seemed a waste to revisit old arguments. The appeal of the unknown beckoned. Forming no specific date in his mind as a specific destination, he simply abstracted the notion of fleeing forward into the future in a mental gestalt the device could understand.

Far to the west, glimpsed through tall windows, something huge and bright parted the sky

GO, he thought. *JUST GO!*

The ThingThatRearrangesNowAndWhen folded sideways upon itself and was gone. The light of its transition was blinding, but even that was lost in the terrible glare that followed. The workroom's thick granite walls whirled away like brittle parchment. The heat was terrible.

Maker sneezed and shivered involuntarily. Wherever he was, it was dark and damp and cold. His scales itched. He reached around to free his bent tail, pushed hard, and was ejected from the transport cavity. He thumped down onto a slick stone floor and found himself sitting in a puddle of icy water. His shout of displeasure came back at him in a profusion of deafening echoes.

Stiff and cranky, he got to his feet and felt at his apron for the pocket with the gas torch. The device roared into life at a touch, its bright yellow flame banishing the darkness. The shimmer behind him he identified as the time device, now glowing faintly as it rebuilt its energies.

A quick scan of his surroundings showed that he was in a large cavern. Here and there in the stone trapped sea shells glistened, prompting him to guess that the city's high promontory had been plunged beneath the sea and then slowly raised back up as mountains. The dripping rock walls were hung with shadows, and from one such opening a cold breeze blew. Luck was with him, an exit.

Much relieved to be out of the damp, Maker stepped out into a starry night. A sliver of moon was hung above a strange forest of trees, very unlike the tropical vegetation he was acquainted with. Everything smelled strange. Before him was a road, unpaved dirt rutted with cart tracks. Primitive, yes, but just seeing the cart tracks made him give a long, satisfied rumble of relief. It proved that someone had survived the disaster. No doubt descendants of the southern refugees, many generations removed. Would they remember their long-lost great-grandfather after all this time?

Bending low, he studied the tracks scattered in profusion across the soft dirt: odd curved indentations, curious half circles lacking claw marks. Doubt nibbled at his confidence as he realized that these shapes were very unlike his own feet. "What strange beast could make marks like this?" He wondered aloud in bafflement.

A distant clatter made him extinguish the torch and stand up straight. Something was coming. An animal, large, and running hard by the sound of it.

Casting aside the doubt, and eager to meet the lucky survivors of his kind, Maker stepped out into the center of the road and struck a confident pose. Now others would know he too had lived, and by his wits, not luck. He only wished that his mate of many years could know of his triumph.

The bizarre beast that rounded the bend in the road made Maker's mouth drop in surprise. It was like nothing he had ever seen before, a top-heavy, lopsided creature having four long legs, a narrow head atop a long neck, and a huge shiny lump on its back. Even odder, a long spine protruded from the right side of the beast. The spine had been thrust at the starry sky above, but as the creature caught sight of him, the spike dropped into a threatening horizontal position, and its tip looked very sharp and hard.

Two more of the creatures came around the bend, just behind the first. They lacked the spiked appendage, and both came to a sudden and unsteady halt as they too, spotted Maker blocking the road.

At that moment, the lead beast broke into a galloping charge, its spine aimed directly at Maker.

The new moon gave almost no light at all so, feeling uncomfortable in the darkness, Maker fired up the torch again and adjusted it to maximum brightness. As the yellow flame shot out, it gave an unexpected result. The charging animal staggered in fright and reared back on its hind legs. As it did so, the lump on its back—and with it the aggressive looking spine—fell off onto the road with a clamorous clash of metal.

Dead silence. Then the four legged animal screamed, reared, and galloped back the way it had come, abandoning that major part of itself that was lying still on the road.

Maker thrust the torch at this strange object in order to see it better. But as the flame brushed it the heap of metal made a great shout and stood up on two legs. Lifting the spine again to a horizontal position, it ran at Maker, angling to avoid the hot flame from the torch. Back at the bend of the road, the other beasts were making loud, apparently approving noises.

Was this some sort of ceremonial greeting? As Maker watched in bewilderment, the creature ran up and pushed the sharp tip of the long spike right against his left leg, where it wedged itself between two thick protective scales. Maker yelled and hopped backwards, but not before the creature struck at his waist with a long metal knife, severing the belt of the apron.

This was too much! Maker bellowed, reached down, pulled the spine free and broke it like a green stick. Then he snatched up the creature . . . easily done since it was but half his size . . . and began to peel off its metal plates. It made a terrible fuss about this, but Maker persevered until he had it stripped down to its pink, naked skin. Then, recognizing it as one of the squeaky pests that had infested his workroom, tailless and grown unnaturally large, he almost dropped it in disgust.

He was about to bestow a good stomping on the creature for giving him such a fright, when its two fellows launched a veritable hail of sharp sticks through the air in Maker's direction.

Aggressive little vermin! This was intolerable!

Chucking the squirming beast that he held straight into the faces of his attackers, Maker retreated to the cave and rolled a massive boulder against the narrow opening to block it. The time device was now glowing brightly, fully recharged.

Maker gave a great sigh. If this was the future, it was a sore disappointment. His kind must have perished completely if vermin had taken over the world.

Mounting the ThingThatRearrangesNowAndWhen, he wriggled inside and imaged another destination in his mind, this time being very specific about the date. The rainbow brightness came again and the device vanished with a sizzling pop, leaving only a steaming puddle on the cavern floor.

Crawling out into an already hot Cretaceous morning, Maker was delighted to see a barren, stony plain stretching away on all sides. Clusters of clay huts nestled under distant cliffs. The history scrolls had been specific about who had lived here. The huts belonged to the Shapers who would rear the first foundations of the city. Several had already seen him and were cautiously approaching.

Maker could not smile, his big, slabsided face was not constructed for it, but he was very, very pleased. There *was* time, now. Fleeing to the southern continent had failed, and retreat into the future had proved impractical. He glanced up to where the full moon was just setting in the bright blue sky. The great glass on the mountain had shown the existence of other retreats circling in the starry void. With his knowledge and teachings, they would find the way to them. Or, perhaps even discover how to turn the destroyer itself.

This resurgence of hope filled Maker like a good meal. He missed his apron sorely, but there was nothing in it that he could not create again, given time. He raked a muscular foot against the rock and sparks flashed from his talons. One thing was sure. This time, this world would *not* become a sanctuary for verminous, squealing wallrats.

And, on the subject of vermin, at just

that moment, many millions of years up the time stream, his lordship, the Right Honorable Sir Gregory James of George was standing bruised and bloody in a pub with all eyes on him. He was recounting how, that very night, he and his squires had come upon a most fearsome dragon rearing erect and challenging in middle of the East road, the creature spitting fire and bellowing like Satan himself, until Sir Gregory had fearlessly speared the beast. As proof of his encounter, the disheveled knight held up a singed length of shattered lance. Deep claw marks still marked the dense wood. He finished with a brave tale of how he and his squires had driven the fearsome monster into one of the caves of Hollow Wood and had sealed it permanently inside. But not before shaming the devil-beast by robbing it of its most basic possession . . . its trousers!

As the crowd in the common room shouted and howled with laughter at this wondrous deed, his squires came forward, straining to hold the great weight of Maker's huge apron between them, its many pockets bulging with a host of mysterious and no doubt devilish devices. Tomorrow, Sir Gregory swore, they would do the Godly thing and put the whole of it into a great purifying bonfire 'til only cinders remained.

Predictably, the crowd roared. ■

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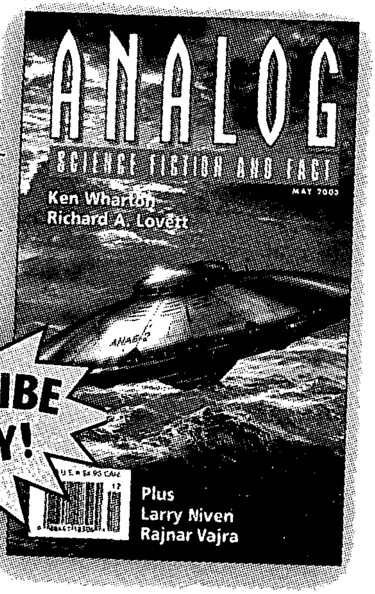
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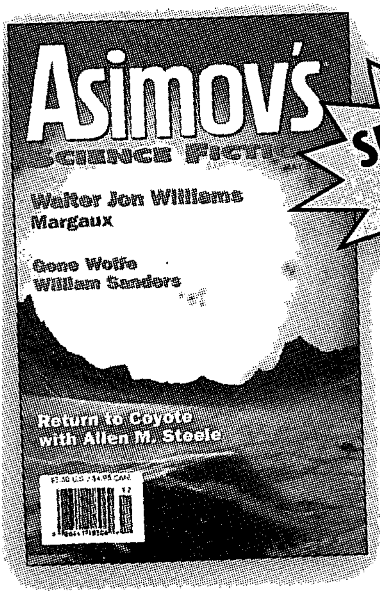
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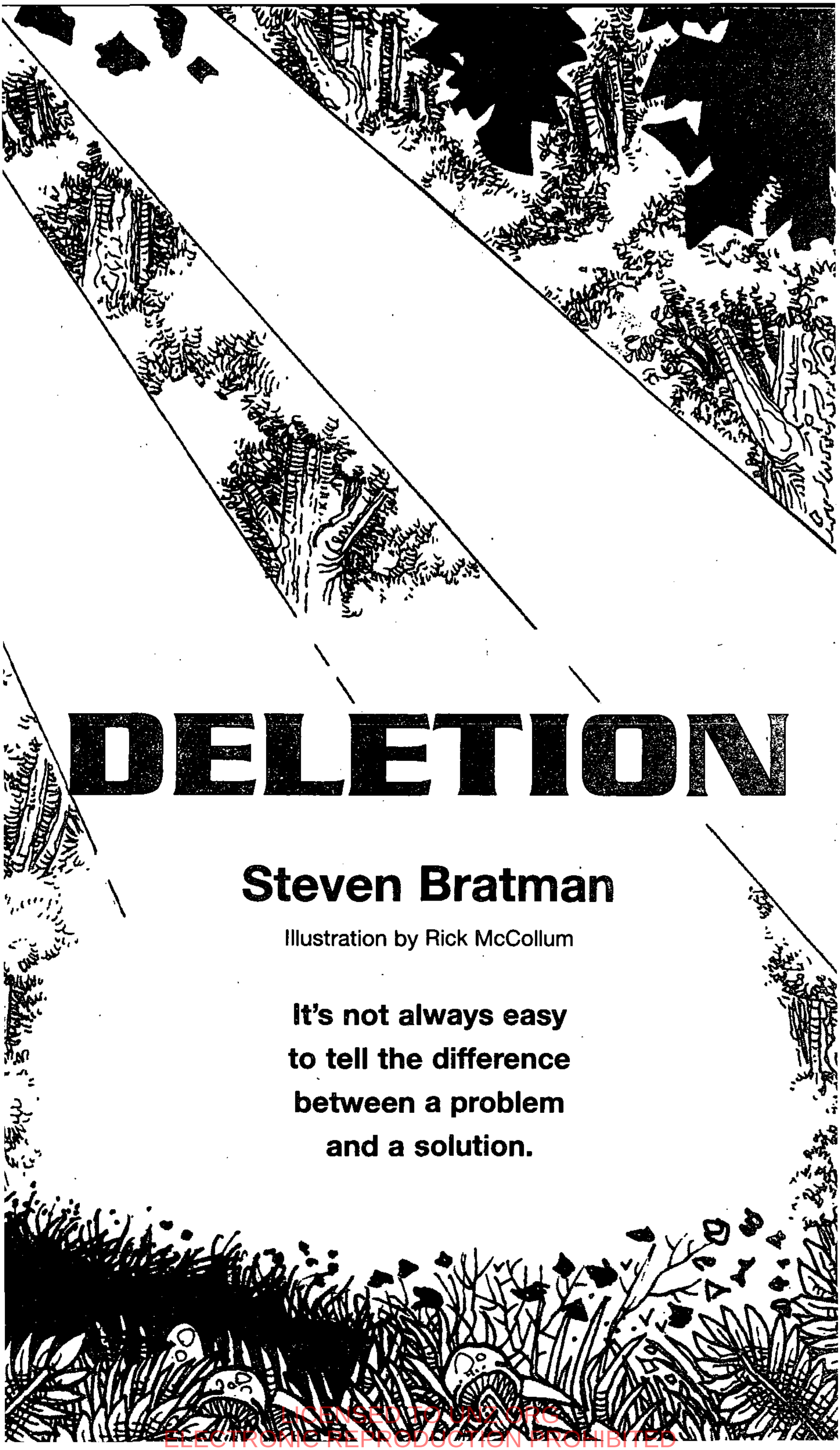


DELETION

Steven Bratman

Illustration by Rick McCollum

**It's not always easy
to tell the difference
between a problem
and a solution.**

Susan wished she could put off telling him, even waste the whole hour in therapeutic pleasantries, but she couldn't think of any other topic to talk about. So when she took her seat beside the therapist's desk, she blurted it out straightaway. "My DNA's defective," she said. She took a strand of her long black hair and ran it through her fingers.

The therapist gave her a kindly look. "I was expecting something like this to come up. It's a normal psychological response. When someone's gone through as many losses as you have, it's natural to feel that something's missing on the inside and not just the outside."

She involuntarily tucked her prosthetic left arm against her side. If only he were right. If only what she'd discovered were some kind of psychological hallucination.

"For a beautiful young woman such as yourself to lose an arm—that's a lot in itself. Add to that your recent breakup with your middle-term lover, Bruce, and the context of your childhood trauma; well, anyone's reality might distort a little under the circumstances."

Susan stiffened at the mention of her "childhood trauma." Even though it had happened more than two decades ago, she still couldn't reduce that tragedy to a mere two-word clinical term. She *saw* the faces of her childhood Friends whenever she thought of them, heard them cry in terror as the fire moved closer. The image made her shudder, and also set her heart aching with loneliness. Her lifelong sense of isolation had begun the day after her First Friends died.

Dr. Frazier drew a prescription pad from a drawer and slapped it on his desk. "There's nothing wrong with your DNA, of course. We can take care of this little introjection with a couple of medications. I'll prescribe something to increase your serotonin 2a receptor sensitivity, and something else to decrease dopamine 3d receptor sensitivity. But the combination might make you overconfident." He held his stylus—an archaic pencil, really—poised in the air above the pad. "So, let's blockade some dopamine 2c receptors while we're at it."

Susan fiddled with her necklace and glanced around his peaceful, orderly office, with its potted plants, plasma-screen walls and clasped-hand-themed furniture. She liked Dr. Frazier's version of reality better than her own, and she didn't want to prove him wrong.

"Then, to get at the software side of your discomfort, I'll prescribe a few affirmations." He tapped his front teeth with the top of the pencil. "How about this series? 'The core of my being is whole and complete. I have everything I need inside me. I will move forward and create a new life.'"

He was such a sweet man. As usual, he wore a classic early twenty-first-century suit and tie, and had his long gray hair tied in a ponytail. And he'd gone to the trouble to obtain a pencil and a pad of paper. She could almost imagine that he'd set the whole stage to honor her professional expertise in the millennial period. He was that kind of therapist.

The thought of his kindness gave her courage. "But that's the point, Dr. Frazier. I truly don't have everything I need inside me."

Ignoring the kindly expression on his face, she drew up her necklace and unscrewed the SecurePak hanging at the end of it, warm from contact with her body. She dropped it into the PakDock on his desk.

"Go ahead," she said, using her human-to-computer tone. "Show him the file.'"

Her computer back at home responded to the command, and a window opened on her corneal screen. Her therapist, she knew, saw the same image: twenty-three human chromosomes. One chromosome opened up to reveal separate gene groups, and a gene group half way down expanded to show five genes in a row, colored bright turquoise.

"Pretty nice program," he said. "Is it shareware?"

"Yes," she said. "What you're looking at is the normal human genome. Do you know what that particular gene group does?"

"No, but I can find out."

He gave some commands to his own computer. A small window popped open, showing a brain with several bright red spots, and beside it, a paragraph of dense scientific text.

"Those five genes code for a neurotransmitter in the serotonin family," he read. "It's not one that's been investigated yet. There are lots of those." He moved the cursor to indicate the red spots. "Hypothalamic, ventral tegmental, prefrontal. Interesting. Apparently, it affects some basic emotional drive."

"How basic? As basic as hunger and sex?"

"Somewhere in that vicinity."

That figured. She couldn't be missing genes for, say, shapely toenails. It would have to be a basic emotional drive.

"Why are you interested in this particular neurotransmitter?" he asked.

Her jaw cramped, and she pushed her finger into the tender muscle. Computer, show him my own DNA."

The representation on the screen went through the same evolutions with a new set of chromosomes. This time, instead of five turquoise genes, it showed five blank spots.

"You see, I don't have those genes. They've gone missing." She tried to keep her voice level, but the pitch rose anyway. "It's not an introjection. I really *am* defective. I'm missing a basic human drive. I'm not quite human."

"Let's not exaggerate," he said. "I'm sure everything's . . . fine."

"Oh. God. You don't exactly sound convinced."

He returned his focus from his corneal screen and made eye contact with her. His gaze radiated calm and support. He reached over and gently patted the back of her right hand, which, she now noticed, had taken to gripping the desk after it left off massaging her jaw.

"Don't worry," he said. "Everything will be okay. Just give me a second to take a look at all this."

She breathed deeply, and tried to release the terror. After a few slow breaths, she felt a little better, and asked, "What kind of doctor should I see about this? A geneticist?"

His gaze flickered outward again. "You don't need to see anyone else. This kind of problem falls within my expertise." Back to his corneal screen, back out. "Why'd you get your genome profiled, anyway?"

"I'd been obsessed for weeks with the idea that I had defective DNA. Introjection of all my outer losses, like you said." She tried out a cute laugh. "But, funnily enough, it turns out that my DNA *is* defective."

Frazier folded his hands on the desk. He was authoritative again, fully under control. "Your DNA has been checked many times in your life, Ms. Frazier. I'm sure there's an explanation for this apparent discrepancy. I'll look into the matter, and get back to you. Probably sooner than you expect."

She attempted a smile, and found that she could carry it off. "I'm sure you will. You always call back sooner than I expect."

She removed her SecurePak from his docking station, briskly screwed it back on to her necklace, and dropped it between her breasts. He kept up eye contact and a smile as he walked her to the door, but when she turned around to wave goodbye, she saw his eyes refocus inward.

Susan stood just inside the waiting room door and looked across to the reception window. Using a human receptionist was another one of Dr. Frazier's personal touches—and one that Susan could do without. His receptionist talked too much and about nothing. However, there was the matter of payment, so Susan steeled herself and walked over. To her pleased surprise, a pleasant new face greeted her from behind the desk.

"I don't think we've met," the young woman said.

"No, we haven't. I'm Susan Frazier." Susan put out her hand and they shook through the window.

"Professor Frazier? From UCLA?"

"Yes. Do we know each other?"

A financial authorization window popped up on Susan's corneal screen. Somewhat awkwardly, she maneuvered the cursor to click on "yes." She hadn't quite gotten used to her new BrainMouse.

"I took your 'History of Prize-Giving' class," the receptionist said. "I think you're brilliant."

"Thank you so very much." Susan rested her elbow on ledge. It wasn't often she got a compliment on her professional work. Few students gave her a grade above a B, and her colleagues had written her off years ago as too timid to amount to anything. "So you must be a history major. Working here to put yourself through school?"

"Yes. I'm taking another one of your classes spring semester. 'The End of the Nation-State.'" She smiled apologetically. "If you don't mind my asking, are you and Doctor Frazier—my Doctor Frazier, I mean—biologically related?"

This was the kind of small talk that Susan usually disliked, but just then she found she appreciated it. "Actually it *is* a bit of a coincidence. He's my biological father."

"Isn't that funny! Think of the odds against something like that happening."

Susan felt a ripple of affection for this bright young woman, and considered inviting her out on a Friendship date. Then she thought better of it; no doubt Dr. Frazier would consider it a boundary violation for his receptionist to date a patient. Still, Susan kept the conversation going for several enjoyable minutes before finally turning to go. And when she finally stepped out onto Melrose Avenue, she felt cheerful and positive, as if her life could go on.

* * *

However, by the time she'd walked a block, she felt terrible again. What was the use of a Friendship that lasted only three minutes? It only rubbed the wound.

Most people used their childhood Friends to form the nucleus of a strong Inner Circle, but the fire had taken that option away from her. She'd never managed to form an Inner Circle at all, and instead had to rely on Affinity Friends. And they were so damned unreliable, no matter how much you did for them. When she'd lost her arm she'd lost half of them anyway. How could you keep up a rock-climbing Affinity Group when you couldn't rock-climb any more?

A cool breeze came up and she wished she had a jacket. The air seemed to pierce through the holes left behind by her missing genes. Five holes in every cell of her body. Her body sang like an Aeolian harp, crying, "I'm damaged. I'm defective. I'm not really a person." She caught herself saying the words aloud, and clamped her jaws shut.

A crèche mother came along the sidewalk toward her, herding twelve children. One little boy was carrying on a blustery conversation over his shoulder with the boy behind him, and he blundered directly into Susan's legs. She laughed, took him gently by the shoulders, and guided him back into the stream of his mates. The boy grinned at her and twisted his chest to show off his Prize pins on his shirt. She acted properly impressed, and waved him on.

At least she was normal in one way—she liked children. Maybe she should get pregnant soon and help keep up the world's stock of children. It would be nice to have a whole new group of Affinity Friends, all those pregnant mothers with whom she would take classes during the interval.

Or maybe it wouldn't be so nice. Once she'd birthed her child and sent it off to its crèche, she'd lose every one of those new friends. What was the point of gaining a connection that you would lose in a few months? She needed something she could count on to last.

She came to a stop at the flycycle taxi stand. She'd been planning to grab one and fly it to work, but just now she felt too lonely. She couldn't stand to become another isolated dot moving above the city, tracked only by the owner of the flycycle, and only for financial purposes. She ached for some sort of linkup.

She could pick up some guy at a bar, but she wouldn't really have time to sleep with him before class.

She could go to the faculty lounge. Only, collegial relationships didn't interest her much. They always foundered on academic squabbles.

Then she remembered the Woods. A small finger, as she recalled, reached down toward this area. She could cut through the Woods on foot and still make it to her lecture on time.

She walked rapidly along various side streets until she found one that touched the vast expanse. A path led off from between a hairdresser's salon and a shop that promised to upgrade your BrainMouse "while you eat." She opened her purse to make sure her Fem-Def III was loaded. People said she didn't need it because the HollyWoods were under constant video surveillance, but it made her feel safer. A quick check showed at least a hundred microbullets in the clip, and she set off into the trees.

Some of the trees in this part of the Woods were particularly large. She touched the bark of a giant live-oak, and wondered if it went all the way back to 2020, when trees first began to fill the space left behind by the suitcase nuclear bomb that had cleared away much of Los Angeles. That would make it eighty-five years old. "You're an old, old man," she said.

The contact with an ancient tree cheered her, and she slowed her pace to amble along a foot trail, its dirt packed and dustily visible beneath a layer of pine needles. In a few minutes she reached a small clearing illuminated by two parallel shafts of light. She sat on a stump and allowed the forest quiet to seep into her brain.

Her mind grew still and transparent. She felt like one of the dust motes she saw moving tranquilly in the illuminated air. "I am one with you, part of you," she whispered. "I came from nature and I will return to nature."

But before she could recite the next line of the Litany of Belonging, a telephone call came.

It was David Frazier.

She maneuvered the cursor over the answer icon, clicked and heard the connection indicator in her left ear. "Bad news?" she said.

At least, she'd have the satisfaction of saying "I told you so."

"Not at all. Those genes you're missing—the fact is, we're *all* missing them. I checked Fryley's Current Genome Report."

It took a second. When she understood, relief flooded her, followed by chagrin. She had missed the obvious explanation and concocted a sinister one. "I'm such an idiot," she said. "It was just a gene correction!"

They were forever putting out those things, infectious retroviruses that repaired unhealthy genes in the world's gene pool. You came down with a cold, or so it seemed, and afterwards you were immune to Parkinson's, or Alzheimer's, or atherosclerosis.

"That was my first thought too. However, I'm aware of every psychiatric genetic correction that has ever been carried out, and those genes aren't among them."

"You're sure they're psychiatric?"

"Considering the part of the brain they affect, yes."

"That's really strange then." She stood up and wandered around the clearing. "If those five genes weren't removed on purpose, why don't people have them anymore?"

"It gets stranger. I checked all the way back to the first Revised Standard genome, dated 2014, and the genes were already missing back then. So what I want to know is, how did *you* come up with them? They don't seem to exist."

"I used the original human genome report. I ran the comparison myself, with that shareware program you saw . . ." She let her voice trail off, embarrassed. She should never have bothered him with such an amateurish effort.

She returned to the stump, sat on the dirt beside it, and hugged her knees.

He laughed. It was almost a giggle. "That's so classic. Exactly the sort of thing a historian would do." His voice became educational in tone. "It's true they 'cracked' the human genome in 2000, but they only got the details about 95 percent right. That software should have found more than a thousand discrepancies between your own DNA and the Human Genome Project report listing. The only reason it didn't was that you'd turned on a couple of strange search filters."

"I wondered what those were . . . I feel so ashamed."

"Don't. You appear to have stumbled on something important, even if you made mistakes to get there. I looked closely at the missing genes, and found signs of deliberate deletion. You wouldn't notice unless you had a specific reason to check, but the indications are there."

"So you're saying those genes actually *were* deleted?" Professional curiosity pushed away emotion. "But when? Since, as you say, the genes were already missing by the time of the first Revised Standard genome, we have to postulate a deletion between 2000 and 2014. They hardly had genetic correction technology back then."

"They did have the rudiments. Think of the Green Plague."

Her thoughts churned. It was true. Molecular biologists had already been experimenting with retroviruses to alter DNA by the middle 1990s. In 2006, some genetic hacker had released a simple retrovirus that added a green pigment gene to everyone's skin cells. Scientists had reversed it in 2008, with the first worldwide gene correction. By 2015, the world's DNA had been secured against unauthorized transformations. "I suppose it's possible someone could have managed it. But why?"

"It's square in the Decades of Terror. I'm thinking an unrecognized attack on the genome."

She held back a sharp reply, reminding herself that she was talking to her therapist, not a fellow academic. "It doesn't make sense logically. What would be the point of a terrorist attack if no one noticed?"

"Maybe terrorists developed it and then changed their mind, but the gene-changing retrovirus escaped on its own. Or maybe their lab got bombed just after releasing the virus, and no one survived to tell the tale. There are lots of possibilities."

Susan opened her mouth and shut it again. It *was* possible. And you couldn't argue with the deliberately deleted genes.

A discovery like this could win you a big Prize. Maybe the Nobel. And with David Frazier's help, she might have the courage to go somewhere with it.

"When are you free?" she asked.

"Actually, I'm free now."

She'd call her T.A. and tell him to teach the class. That's what T.A.s were for. "I'll meet you outside your office. Give me five minutes."

She brushed pine needles off her dress and straightened her blouse. She discovered a small tear in her left sleeve, but after pinching the fabric between her fingers to examine it, she let it fall. Nothing mattered compared to this. If she won a Nobel Prize, that would make up for all her grief.

He saw her, waved, and walked jauntily down the steps. Susan had never seen him outside his office, and she felt suddenly awkward and unsure of herself. She felt more awkward still when a form titled "Consent for Breach of Boundaries" appeared on her corneal screen.

"I'm sorry to have to do this," he said, "but it's required."

She scanned the agreement. "I acknowledge," it read, "that my personal therapy with David Frazier, M.D., Ph.D., will now come to an end, permanently, to be replaced by a new relationship, category Collegial. I understand that no romantic relationship is contemplated, nor any other relationship banned by the Asymmetrical Power in Relationships Act of 2065. My rights to sue Dr. Frazier if he proposes any relationship in violation of that act are fully protected."

She electronically signed the document, impatient to get on with things. But as soon as she'd done so, a sense of emptiness flooded through her that threatened to burst out in tears. It would be wonderful to work with him as a colleague. Only, what would replace the unconditional love Frazier had provided her as a therapist? How would she make it? How could she survive?

He touched her on the elbow and said, "It'll be okay."

Anyway, she consoled herself, there might be a Nobel Prize at the end of it.

They walked along the crowded sidewalk of Melrose Avenue. A young couple on glideboards raced toward them; when collision seemed inevitable, the boarders swerved away with an impressive sound of wheels scraping on cement. Across the street, message boards on a dozen buildings synched up to display an ad for Hawk's Embedded Vision Enhancers. A large passenger transport roared into motion and blocked the simulated Hawk's-Eye View. Flycycles careened overhead with their strange dopplerized whine.

David gestured at the scene. "You're a historian. Has anything changed so much about the world that the cause has to have been genetic?"

Another pair of glideboarders passed by, irritatingly close. "Not those damn things," she said. "They've been around since last century."

"I used to ride glideboards."

"So did I. I used to wonder why grownups gave me those nasty looks. Now I know. Your question's hard to answer. There've been so many big changes that I don't know where to start. Consider those two people, for instance."

She pointed to a man and woman who held hands and peered into a shop window. They each looked at least sixty years old, maybe seventy.

"Up until this century, we would have taken them for a married couple. But do you know anyone who's married? I don't. That's a huge change. People were getting married for thousands of years. Perhaps our gene deletion took away the inclination."

"How can we tell?"

"We can't. Marriage was already declining by the 1960s, decades before anyone knew how to delete genes. It might be a purely cultural change."

They were passing the West Los Angeles Soccer stadium. A small crowd had gathered to watch the action on a huge screen set into the side of the building. To Susan's amused surprise, David stopped walking and watched alongside them.

"I wouldn't have picked you for a soccer fan," she said.

"Oh, yes. I used to play soccer, myself. Team 15, one of the two teams competing now."

That gave her an idea. "So they're your favorite?"

"Not at all. I think Team 47 is stronger."

"That's not what I meant. Which one do you *want* to win?"

He gave her an uncomprehending look and returned to the screen. He pumped his right arm, and shouted, "Yes!" The crowd screamed its satisfaction.

"What happened?"

"Team 47 made a goal."

"Were you any good?"

"What?" His eyes stayed glued to the

screen. "Oh, rather. Yes! Look at that, oh my God. What a play!"

He and the crowd cheered again. When they'd finished cheering, he turned and gave her a charmingly sheepish look. "Team 15 scored. I'm sure this bores you."

"The game does. But not your reaction. You see, up until this century, people cheered for one side or the other, not both."

"Really?" he said. "I had no idea."

"I don't know if that indicates a genetic change, though."

Across the street, a gold and green pagoda stood in the center of a large parking lot. Ornate script carved into a large wood sign read, "Temple of Eternal Friendship." She pointed her chin toward it and said, "Those are new."

"Really? The didn't have Friendship Pagodas last century?"

"No, but I don't think that signifies altered genes. People have always had friends. We just didn't realize the true importance of friendship until this millennium."

"So what would be at the top of your list for a change so dramatic it might be genetic?"

She thought about it. "Maybe the sudden way countries disappeared."

The doors of the Friendship Pagoda opened and a stream of monks poured out. Their yellow robes gleamed in the sunlight. Instead of Prize pins, they wore the Friendship logo—two hands clasped—to show they'd put friendship above personal ego. They filled the air with a loud and joyful hymn to Friendship.

"Come on in here," David shouted. "So we can talk."

Susan genuflected before the monks. She admired them deeply, and had often wished she heard a call to their vocation—to renounce romance and status, and give herself over to pure Friendship. However, she could never find the bravery to relinquish what few things she had in life that at least gave her some satisfaction.

No, monastic Friendship was out of reach. But why couldn't anyone invite her here to take Eternal Friendship vows? She'd stood outside pagodas like this one many times hoping that someone would ask. No one ever had.

She gave a wistful sigh, and allowed David to tug her into a nearby café.

Dozens of people in animated conversation sat at a long, communal table. Behind a counter, a machine gave off loud jets of steam as a barrista made espresso, chai, and marijuana drinks.

David escorted her to a personal table, and, with elegant courtesy, took his seat at precisely the same moment she did. What a nice old-fashioned way, Susan thought, to signify that they had become equals.

After their coffees arrived, he said, "Tell me more about countries. Were they anything more than glorified administrative districts?"

She held the steaming cup between her real and prosthetic hands, and let the fragrant steam soften the skin around her eyes. "They felt passionate about their administrative districts back then. One fellow famously said, 'I regret that I have but one life to give for my country.' It was called patriotism."

"People really felt that way? I'd assumed it was all government propaganda."

"A lot of that, too. But patriotism was a genuine emotion. Before nations, people gave their lives for their kingdom or city-state, or tribe. Can you imagine ever wanting to die for a group? I can't."

"Only an insane person could want that," he said.

"Unbelievable as this may seem, as recently as a hundred years ago, it was considered one of the most noble emotions imaginable. At least, when the person feeling it was on your side."

"How bizarre. Though I do remember learning something about it in school. I'm trying to recall what I wrote on some test or other . . . that all the groupisms disappeared as a psychological reaction to the world wars of the twentieth-century and the decades of terrorism of the early twenty-first. Wasn't that it?"

"That's one theory. Personally, I give a great deal of credit to the Scandinavian pacifists, like Henrik Norsgald."

She said the name with reverence, and saw an expression of the same feeling flicker across David's face. Most people regarded Norsgald as larger than life, a civilization-builder like Hammurabi, or Moses, or Solon. He'd helped the world find its new footing when the nations collapsed, and laid out the basic principles of Friendship, romance, and Prize-winning that everyone now lived by. Who could tell how many changes in the world were actually due to the force of his eloquence?

"Other theories focus on the spread of neo-Confucian ethics." She took a sip of coffee. "But maybe all those theories are wrong. Maybe a retrovirus changed people so much that they didn't want countries anymore."

"We're here," he said. "My house."

After they'd left the café, David had stopped at a pharmacy to retrieve a package, and then led her along various side streets toward his home. For the last few minutes, they'd walked down a very long city block lined by a single high stone wall. Now they'd reached a gated opening. David gave a silent electronic command, and the gate swung open. They stepped inside.

They must have passed through a noise-canceling barrier, because in an instant all the normal city sounds became obvious by their absence. The dopplerized whine of flycycle taxis, the sound of hurrying feet, the happy screams of children and the solemn chants of monks: it all disappeared. The gate shut closed behind them, and Susan found herself in a quiet, walled world.

Politeness demanded that she show frank envy, but Susan would have gaped anyway. She'd known Frazier was rich, but this estate of his far passed her expectations.

They were standing under a canopy of tall live-oaks. Down a slight hill before them, the trees shrank to shrubs, and then gave way to an ocean of flowers. A large house stood off to the side, in classic twentieth-century Hollywood-star style.

"It's incredible," she said.

"I inherited it from my mentor in medical school."

In the old days, Susan realized, David Frazier would have willed his estate to *her* after he died. Or jointly, to her and her siblings, whoever they might be. Now he'd pass it on to one of his Friends, or a student, or a colleague.

Too bad. She'd love to own a piece of this heaven.

He led her along a path that passed through the flowers. They wound their way to the other side of a stand of tall roses, and arrived at a field of dahlias. The flower's stalks traced out a swooping curvilinear pattern reminiscent of a raked Zen garden. Beyond the dahlias, they reached a sort of gazebo in the center of the garden, made of a dozen or more intertwined cedars. The trees leaned toward each other as if they'd grown up under the influence of a prevailing centripetal wind.

David motioned her to sit at an elegant glass-and-ironwork table in the center of the gazebo. He set his package on the table, and busied himself at a compact kitchen that ran along the north wall. After a bit, he brought a large clear bowl to the table, along with two glasses of ice water. He opened the package, removed a large bottle, and poured at least a hundred capsules into the bowl. He took a seat beside Susan, and said, "This is it, the absent neurotransmitter."

Susan took one of the capsules and held it to the light. "If we swallow these, we'll know what the world's lost?"

"Approximately." He picked up a capsule and rolled it gently between the forefingers of each hand. "Genes create proteins that affect other proteins, and lead to many downstream results. It's relatively easy to calculate the primary final product of a gene group, and that's what these capsules contain. I can't determine the secondary products without actually inserting the gene into a mammal, and that takes time. Most likely, this drug will create a simplified, exaggerated version of the missing drive. Still, it should give us a sense of what we're missing."

"You're sure it's safe?"

"I gave the pharmacy both our genomes. The drug's not toxic to either of us. I *don't know* what it will do, though." He smiled mischievously, and popped the pill in his mouth.

She shook her head. "You therapists are all alike. Too comfortable with mind-altering drugs." She gave him a soft look to show that she didn't mean her comment as a serious criticism, and returned her attention to the pill in her hand.

Would it take away her lifelong emptiness? She didn't have any rational reason to think so. Everyone in the world, apparently, lacked that gene group, and most people felt just fine. Her sense of isolation was a personal problem, not a universal one. Still, intuition told her that once she swallowed the pill, she'd never be the same again.

"If I don't like what it does, how long will it take for the effect to wear off?"

"About two hours. It's short-acting."

"What the heck, why not?" After all, she'd taken mind-altering drugs all her life, for therapy and for recreation. Everyone did. She dropped the pill in her mouth and swallowed it with a sip of water.

"How long till we feel something?" she asked.

"I'd guess maybe twenty minutes."

They didn't have much to say after that. The minutes passed slowly. After about half an hour, she began to wonder whether they needed a higher dose. She raised her eyes to mention it, but before she could say anything, she noticed a strange look on his face.

"What are you thinking?" she asked.

"Something very bizarre."

"Tell me."

"That . . . that I'm proud of you for making this discovery."

She turned her head away at the ridiculous words. She wasn't his protégé. How could he feel proud of her?

Still, something in his glance intrigued her.

"That way you're looking at me," she said.

"Am I? Looking at you in some special way?"

"I *think* you are."

"What's it like?"

She studied his face and wondered where she'd seen an expression like that before. Perhaps on an Affinity Friend, when they'd accomplished something together? Or on a lover, right at the beginning, when things were hot?

Not really. Those expressions celebrated a moment that would pass. David's eyes seemed to say that she *permanently* mattered to him. That he felt connected to her in some way that could never disappear.

Which was ridiculous. They would publish a paper together, share fame and Prizes, and eventually their collegial relationship would fade away. All relationships disappeared in time, except vows of Eternal Friendship, and she and David hadn't come close to that.

Though, come to think of it, there used to be one kind of relationship that didn't disappear, and that didn't depend on any particular vow.

Whether or not you liked someone, if he or she were a close biological relative, you were bonded to that person forever. Blood, they called it. Blood, thicker than water, the most reliable relationship of all.

She understood now. David was gazing at her like a person out of the history books, a kind of person that no longer existed.

She recognized that loving, proud, possessive look on his face as the look of a *father.*

* * *

She wanted to cry with joy. She wanted to sing. All her life she'd imagined herself an isolated speck of a person who moved through the world alone, her life and death of no personal concern to anyone. Now she belonged. She mattered.

"Did everyone back then feel like *this*?" she asked.

If they did, she'd have to reevaluate everything she knew of history, using this emotion as a previously hidden backstory.

His response came after a delay, as if he found it difficult to think. "Something similar, though not as intense. Like I said, this drug is an exaggerated version of the missing gene. It's like heroin compared to the natural endorphin system." He turned to her with a crooked, broken-up face. "It's hitting me like a sledgehammer."

It did feel like a sledgehammer. She almost couldn't bear it. "How about we go for a walk?" she suggested.

"Good idea," he said, with obvious relief.

She borrowed one of her father's flannel shirts to use as a jacket, and set out with him into the failing light of late afternoon. He walked slowly, and kept turning to gaze at her. They followed a trail that led to the high stone wall, and picked up another trail that stretched out along it to either side.

It was dark under the trees. He stumbled slightly and she steadied him.

"Thanks," he said. He pointed up the trail. "I thought I saw a group of young men lurking up there. One of those gangs of sexual marauders that we hear about. It scared me on your behalf."

She patted the gun in her purse. "I think I could take care of myself."

"I'm sure you could. And my property has too good a security system for anyone to get in. But here's what set me off balance: I felt an intense desire to defend you with my life. Now isn't that bizarre?"

"Very bizarre," she agreed.

When they reached the gate, he gave a signal and the massive leaves swung open. They stood within the walls and watched the passing cars and foot traffic move in eerie silence, their noise blocked by the noise-canceling barrier. It was a strange effect, but she sensed something abnormal beyond the silence. She tried to put her finger on it, and failed.

He peered out into the street. "You know, I think maybe I'm beginning to figure it out."

"Figure what out?"

"What this stuff is we've taken."

"What is it?"

He put his knuckles over his lips. "It all fits together. It's unbelievable."

"What fits together?"

"It makes complete sense," he murmured. He held out one finger. "The disappearance of patriotism." He held out a second, and then a third. "The way we raise children. Or don't raise them. Our extreme focus on friendship. It's all the same."

"Quit torturing me," she said. She took him by the shoulders and shook him gently. "What are you getting at? Tell me."

He came back to himself. "Oh, sorry. I didn't mean to tease you." He took her by the forearm. "It's kin selection, Susan! We've lost the drives that come from genetic relationship."

"What are you talking about?"

"You haven't heard of kin selection? Nepotistic altruism?"

"Maybe I do remember something about it from freshman biology."

He took her to a bench situated for watching the street, and they sat beside each other. "Start with the fact that natural selection is about survival of genes, not of individuals."

"Yes, I remember that."

"Relatives carry many of our own genes. Organisms that aid the survival of their kin pass on their genes more effectively than organisms that ignore their kin. This creates an evolutionary force called kin selection. Out of it comes maternal instinct, loyalty to family and, eventually, to clan and tribe. Mothers that don't protect their children don't pass on their genes. The same is true, to a lesser extent, with loyalty to all related organisms. It's called nepotistic altruism. Think about a mother wolf defending her offspring against a mountain lion, and you'll get a sense of its power."

"But a human mother wouldn't risk her life for her children. Oh, I see what you're saying. Parents *used* to act that way. You think that's a big enough change to be genetic?"

"I'd always assumed that humans had simply learned to repress nepotistic instincts, like we repress so many others. Now I don't know. Here's another example. Look out at the street and tell me what you see."

She studied the stream of people passing by. Some had white skin, others had yellow. None were dark Indian-subcontinent brown like her and her father. She'd never noticed that before.

"They're different from us," she said. "Except for that one."

She pointed to an older woman who walked jauntily along the sidewalk with her domesticated miniature rhinoceros. Her dark skin almost matched Susan's own skin. After the woman passed, a large fellow with pale white arms came to a stop and leered at them. David gave a command, and the heavy gate swung shut with a clang.

Susan stood close beside him. Belonging to someone felt even sweeter, she now realized, when you had someone else to shut out.

They had just finished an elegant dinner, and moved to his living room. They sat on matching blue silk couches that faced each other across a granite coffee table. Plasma screens set into the walls displayed a grand mountainous scene. Beside a bar at the far end of the room, a translucent column ran from ceiling to floor, filled with moving images that looked like colorful river stones.

"There's something I don't understand," she said.

"What's that, my dear?"

He'd called her that several times that night, yet it still startled her. She smiled, and then switched to her academic mode. "You said that loss of nepotistic altruism explained everything. But what does it have to do with the disappearance of countries? Loss of tribalism I can understand. The members of a tribe or clan are related genetically. The same for a race, or an ethnic group. However, people in a given country aren't particularly related."

"Oh yes, I forgot to fill that in. Here's how the evolutionary psychologists of the late twentieth-century explained it: The kin selection instincts reside in lower levels of the brain, and are subject to manipulation by higher brain functions, such as our ability to think abstractly. A country is like a surrogate kin group. Think of how people used to speak about their countries. They used words like the mother country, the natal land and the fatherland. They *felt* tribal feelings for their nation even though it didn't make sense genetically."

She'd never really understood how people had managed to get so passionate about their countries. It had always seemed a bit insane, like mass hysteria. But if you hypothesized a misplaced biological kinship drive, the intensity of their feelings made sense.

All the other tight groupings showed the signs too, now that she thought of it. Members of the Ku Klux Klan and the Black Panthers, Christian missionaries and soldiers-in-arms, union members and followers of a revolutionary ideology: they all invoked kinship by calling each other "brother" or "sister."

"I suggest we christen this drug 'pro-kin,'" David said. "How does that sound?"

"That's fine," she said. She shifted uncomfortably on the couch.

In a musing tone, he added, "It's hard to understand how one gene group could affect all the various kin-selection drives. I suppose that pro-kin could facilitate a final common pathway."

She didn't know what he was talking about, and it irritated her. "What was that? You went a little past me."

"Oh, it doesn't matter. Do you want to watch a movie?"

"Now that's a sudden change of direction."

"Or play an interactive? I'm a big fan of Three Kings in Amber."

"I'm not."

He laughed. "I'm only suggesting it because that's what . . . families used to do together. Family! What an odd word."

The cloying sweetness in his voice had been annoying her for some time, and now she realized that she'd had about enough.

"Actually, I think I want to go home."

"So soon?" He sounded hurt. "Well, of course, if you want to."

She rummaged around in her purse and found her hairbrush. She'd straighten herself up a little, then call a cab.

"I think I know what's going on," he said.

"Nothing's going on. I'm just tired." She tipped her head to the side and brushed vigorously. What an incredible bath of emotion the day had been. She needed to get back to the real world where she could give things proper academic consideration instead of pouring her heart out. Though it had been rather exciting.

"You're more than tired. You're feeling cold and distant now, aren't you?"

"Not really." She took out a little mirror and examined her face.

"Of course you're feeling distant. Your blood levels have dropped and you don't have the kin selection instincts anymore." He sounded a little bitter.

"Could that be it? No."

"Think about it."

She closed her purse and reflected.

It was always hard to remember a feeling after it left. She couldn't quite recall how she'd felt under the influence of the drug. But the aching hole in her heart must have disappeared for a while, because now she felt it return with a vengeance. She put her fist between her breasts and breathed hard.

David gave her a sympathetic look, and fumbled around in his jacket pocket. He produced a pill bottle and set it on the glass table. She shook her head. The loneliness ratcheted up another step. She ground her fist against her chest and told herself that she could stand it. She'd stood it all her life, after all.

Only, she didn't want to feel this way anymore. Not now that she had an alternative.

She put out her hand and he tipped a capsule into it. She tossed it down without water, and waited eagerly for the feeling to return.

He tipped the bottle as if to take a pill himself, then hesitated, and set the bottle down on the coffee table. He rose hurriedly from the couch, and crossed the room to the bar. He poured himself a drink and leaned back against the counter.

"The feeling switches off quite suddenly, doesn't it? Must be some kind of threshold effect." He swished the ice. "It's all starting to sound a bit barbaric. Connections based on biology? On 'blood,' as they used to call it?" He gave a self-deprecating chuckle. "I believe I was getting ready to love my administrative district too. Southern California Administrative Zone. Love it or leave it."

"You don't feel anything toward me any more?"

"Not like I did a few minutes ago. In fact, I feel rather numb. Must be a reaction to all those artificially intense emotions we were feeling a little while back."

She reached into the bottle for a second pill, and swallowed it. She took a third and held it up to him. "Have some more pro-kin so you get it back."

He rattled the ice in his glass again. "Not sure I'm ready for another bout of involuntary loyalty."

She must have shown on her face how much his words hurt. His posture softened and he came over and sat on the arm of her couch. "I'm sorry. I shouldn't be so cavalier. I do feel friendly toward you. Just not ready to give my life for you."

She held out her right hand and studied its fingernails. A few of them needed work. She took a nail file out of her purse. Without looking up, she said, "I suppose you just to want to go back to relationship, category Collegial."

"Well, this is pretty fascinating. It's worth a dozen papers. What amazes me is that the drive hits so hard. You'd expect it would take some socialization to produce familial loyalty." His forehead creased and he tipped his head to one side. "Of course, I already knew you quite well, as your therapist. Maybe that could explain it. Though, no, I don't think so. I suppose it's what I said before, that pro-kin creates an exaggerated version of normal nepotistic altruism. A narcotic version."

Maybe so, but she ached for more of it. She wanted to fill up the hole in her heart so completely that she never felt isolated again. If only he'd take another pill. Or several more pills.

She cast around for an angle, a hook that would interest him.

"What do you think higher doses would do?" She used her intellectually provocative tone, while simultaneously suppressing a strong urge to take another pill. It wouldn't do for him to see how much she yearned for the drug.

"Higher? No thank you."

As if he hadn't replied, she continued, reflectively, "I suppose it would tighten familial bonds. We might turn into the Hatfields, and look for some McCoys to hate."

"Hatfields and McCoys?"

She explained the story. He'd never heard it. Of course not. Without pro-kin, no person could comprehend the emotions behind family vendetta. She only knew the story from class.

She rubbed the palm of her hand on the silk surface of the couch. "On the other hand, high doses might expand the kin circle. Turn us into saintly altruists, like the Scandinavian pacifists."

He walked back to the bar, and dumped the ice out of his drink. "It *is* a fascinating thought."

He drummed his fingers on the counter, then stopped drumming and looked at the ground.

"Okay," he said, with sudden determination. "But let's do it right. I have injector sets out at the cedar-tree gazebo, for parties. We may as well study the effect of really high levels."

"You therapists," she said, affectionately. "You're such drug users."

"Why stick with the mental state you have, when you can change it?" He paused. In a sober tone, he said, "Anyway, I miss the feeling. I've never cared about anyone as much as I cared about you ten minutes ago. I want that back."

He swallowed a couple of pills to get started. By the time they reached the gazebo, their shared warmth and contentment had fully returned.

David opened a cabinet and pulled out a pair of injector sets. He carried them to the table, and helped Susan attach the injector pad to her wrist. He connected his own pad, and dissolved twenty pills in distilled water. He poured a cup of water into each pump's reservoir, and showed Susan the slider control that set the delivery rate in terms of blood levels.

"I suggest we start with 10 mcg per deciliter," he said. "We can always increase the level later if we want."

She licked her lips and turned her pump up to 12.5. When she reached across the table to set his at the same level, he raised his eyebrows but didn't argue.

She felt a small drug-like rush, but no particular change in emotion. Perhaps that would take awhile.

She raised both pumps' levels to 15, and relaxed as euphoria filled her.

They sat quietly and listened to the night sounds. A cool breeze struck her legs, and up above, the cedar trees shifted slightly in the wind. The injector pumps hummed as they poured pro-kin intoxication into their veins. Further off, she heard an owl call, and she pictured little mice trembling in the grass. The natural world was so violent.

Of course, humans had once been just as violent. Incredibly violent, on a much larger scale than any animal could achieve.

She tried to imagine what it had been like in the early decades of the millennium. Hundreds of serious terror groups, each sure of its own righteousness. Christian supremacists against Islamic fundamentalists. Venezuelans against Australians. Terrorists with neutron bombs, with powerful poisons, with disfiguring biological agents.

Up until that afternoon, it had all seemed incomprehensible. She'd known the historical details but she couldn't imagine the participants' motivations. Now she could. Back when she stood at the gate with her father, she'd felt a little taste of the groupistic emotions that must have dominated people's lives before the deletion. That white-skinned man had seemed like an enemy, an Other, not quite human. You could kill a person if he didn't seem human to you.

But if it took pro-kin to create that attitude, then . . .

She put both hands on the table. "Wait. Hold on. It doesn't make sense."

David gave her a benignly puzzled look. "What doesn't make sense?"

"Our hypothesis—that terrorists attacked the genome and deleted our pro-kin gene group. It doesn't compute."

"Why not?

"Because terrorists wouldn't deliberately remove kin selection instincts. They needed it to function."

"That's true," he mused. "You couldn't have suicide bombers without kin selection drives..So then . . . then I don't understand."

She did understand, even if it felt sacrilegious to think it.

She felt her father touch her shoulder. "What, Susan? You look disturbed. What are you thinking?"

She dropped her hands in her lap and stared at him. "It wasn't a terrorist that did it. It was a pacifist. Probably Henrik Norsgald himself."

David did more than shake his head. He shook his whole body. "Norsgald? That's absurd."

He couldn't bear the thought that one of the world's demigods had sabotaged the world's DNA. Neither could she. Yet, she knew in her soul that she'd figured out the truth.

The breeze blew against her legs again, and this time she felt cold. She tucked her dress around her knees. "Norsgald went through a public dark period toward the end of the Decades of Terror," she said. "After years of passionate campaigning for peace, he had what amounted to a nervous breakdown. He said that pacifism was a failure, and that maybe the world should just go ahead and destroy itself."

"But pacifism wasn't a failure," David protested. "It was a triumph. Norsgald's philosophies helped change the world."

"Or so we've always thought. Maybe it wasn't his *philosophies* that did it. Maybe Norsgald got sick of preaching and decided to remove the cause of war by force. By biological force."

She tried to picture the events. Norsgald wasn't a biologist. Someone else must have discovered the gene group. Maybe someone in Fredlig Verden, his pacifist organization. He would have put off using the information as long as possible, unwilling to employ violence against violence. But then things got steadily worse. At some point—perhaps the summer of 2011, when over ten million people died in terrorist attacks—the contradiction between his ideals and the reality of human suffering became unbearable, and he decided to release the virus.

It had been an act of incredible hubris, but in retrospect it had worked out. Wars, terrorism, religious and ethnic violence had all disappeared. The world had adapted to the loss of family and group identification, and found a new equilibrium.

And now she and David would undo Norsgald's work! They'd publish their findings, and the government would put out a gene correction to restore the missing group. Familial love would return. That was fine. But all the hateful groupisms would follow too. She and David would have the honor to inaugurate a new epoch of war. A historian's dream, or nightmare.

She could tell by the look on her father's face that his thoughts had gone along the same lines.

He nodded solemnly. "You know what we have to do," he said.

"I don't see any other choice. We can't put ourselves above the welfare of the world. We have to keep this discovery quiet."

He took her hand. "We can't trust ourselves to keep quiet. We won't be able to resist the call of the Nobel Prize. You understand that, don't you?"

She did understand. Slowly, gently, and with a strange exaltation, she removed her gun from her purse and laid it on the table.

Erasing the information on their computers had been easy, but the physical evidence set them more of a challenge. After some consideration, they decided to use the gas barbeque that David kept in the gazebo for parties. The injector sets were made of plastic, and would burn rapidly in the fire. The police wouldn't find any trace of pro-kin to analyze. She'd worried about the pharmacy, but he assured her that personal prescriptions were too deeply encrypted for anyone to find the formula that way.

She helped her father set the barbeque in position, and watched as blue flames leaped up through the coals. She'd never felt this happy. When she checked for the lifelong emptiness in her chest, she found a kind of ecstasy instead.

"For the first time in my life, my whole life makes sense," she said.

"I know what you mean."

The returned to sit at the table for awhile, and enjoyed the fierce beauty of their resolution. From somewhere nearby came the sounds of dogs barking. Dogs, she thought, had plenty of pro-kin still. They possessed territory in common with their owners, and defended it from intruders. Luckily, collies didn't prefer their own kind above labradors. Thanks to the deletion, humans no longer made such fine distinctions among themselves. And, after she and David killed themselves, the secret of those ancient passions would stay hidden forever.

She felt a little head rush and closed her eyes. When it passed, a niggling worry followed, and it troubled her.

What if they weren't thinking clearly? She did feel a little inebriated. More than a little. At these doses, pro-kin certainly was like a drug. What if they weren't making the best choice for humanity, and simply thought they were, while under the influence?

"David—" She touched his hand. "Do you think maybe we should turn down the pro-kin, and check our reasoning when we're not so intoxicated?"

A second later, having answered the question to her own satisfaction, she reached out to turn down the level on her injector set. Her father seized her wrist and held it tight.

"Don't," he said.

"Why not?"

"Because it's dangerous." He gave her a comrade's smile. "Remember what happened last time we let our blood levels drop. We couldn't understand how we'd felt just a few minutes before."

"But we could always take more pro-kin again."

His eyes glittered with high feeling. "Don't you understand? You wondered what high levels of pro-kin would do. Well, now we know. At these doses, pro-kin expands the circle. It stretches the range of nepotistic altruism to reach the whole world, and gives us the willingness to die for humanity. But if we let our levels drop, we'll go back to our old ways of thinking. We'll value our own petty lives above the well-being of the whole."

Her father loosened his grip on her wrist slightly. "We can't let that happen. Do you understand? Do you agree?"

"Oh, yes, I do."

It was a lie. She understood, but she didn't agree. She'd hungered for connection too long and too deeply to give it all up just as soon as she'd achieved it.

Underneath the table, she surreptitiously advanced her prosthetic arm toward the dangling tube that fed pro-kin into her father's body. One quick yank, and he'd understand her objection.

Just as she brushed the plastic tube, his free hand jerked out and knocked her hand away. He twisted her above-table arm into some kind of judo hold, and forced her up and away from the table. She groped behind blindly with her prosthetic arm, but he grabbed that one too, and twisted it so that she had to bend forward or lose the prosthesis. Between her legs, she saw an injector patch on the ground, oozing drug. It must have fallen off in the struggle. Whose was it?

Hers, apparently. Her mind grew clear as the pro-kin levels fell. "David—listen to me. You're drunk. You said yourself that pro-kin exaggerates and simplifies the kin selection drive. You're under the influence of an altruism high. You're not thinking clearly. It's crazy to die for the world when we have each other."

He breathed hard. "You're the one who's intoxicated," he said. "Intoxicated by selfishness."

"Self-sacrifice is just a biological drive gone wrong. There's nothing noble about it."

She tried to get her arms free, but he gripped her tighter. He began to maneuver her into a new position.

"Not true," he said, grunting with effort as she fought against him. "Back in the old days, people who loved others more than themselves were revered as saints. Think of Norsgald. Pro-kin has given us the same perspective. It's the highest, truest way to live."

"Maybe Norsgald had too much pro-kin naturally. Anyway, saints didn't commit suicide."

"No greater love hath any man than that he give up his life for the world. You want connection, Susan? Here's connection."

He shifted her wrists so he could hold both in one hand. She watched as he used his free hand to turn the injector sets up to 25. He reached down toward her unattached injector pad, but she shifted her weight and crushed her right foot down on it. He shoved his shoulder into her back, and grabbed the pad when her foot lifted. She jerked her prosthetic arm free and clawed at his face, but he evaded her. When she felt the soft pad touch the wrist of her right hand, she made one last convulsive effort to escape, but he was too strong. The pro-kin selflessness surged into her, and she stopped struggling.

The bottle of pills had spilled during their wrestling match. Working clumsily because of the tubes attached to their arms, they retrieved the fallen pills and tossed them in the fire. It took awhile. By the time they finished, they had worked out all the details. David would fire the first shot. He'd make sure that she was dead, and then throw all her equipment in the fire. He'd get all his own equipment in position, and toss it in too. They'd chosen him to die second, because, with his greater body weight, he would have a longer interval before his pro-kin levels fell beneath the altruistic threshold. Plenty of time to shoot himself.

They moved the table beside the barbeque, and stood facing each other. "I can't tell how much it means to me to do this with you," he said. His eyes glistened.

"You don't need to. I understand."

He kissed her on the forehead. She hugged him. Then he lifted the gun from his pocket and pointed it at her forehead.

She wondered idly whether she'd hear the gunshot, or whether she'd lose consciousness before the sound reached her ears.

The gun wavered.

"What's wrong?"

The gun lifted, then fell again. He took a step back.

"It's hard. The father-child bond, I guess. I'm having trouble getting myself to kill you. I keep hoping we've figured out something wrong."

"Let's turn up the level," she said. "Or let me do the shooting." She eyed his pump and wondered whether she should make a dive for the control. He saw the direction of her glance and dropped the gun. He didn't move, just stood there, paralyzed, stricken. She kneeled and took the weapon in her hand. As she straightened up, a new idea struck her.

"What you said back then." Her voice sounded thick to her own ears. She pulled out a chair and sat slowly into it. "What you said about how pro-kin helps us see more clearly. Maybe so. But what if our whole thinking is screwed up? What if we're making a mistake because we've lived our whole lives *without* pro-kin?"

He sat in a chair also. She watched him make a visible effort to think clearly. It wasn't easy. "How do you mean?" he asked.

She groped toward the elusive thought. "We've been assuming that the world is better off without pro-kin," she said. But suppose we're wrong. Suppose Norsgald was wrong. He couldn't possibly know what it would be like to grow up in a world with no family feelings, no group connections at all. And we have no idea, really, what we're missing. What if, instead of helping the world, Norsgald stole its heart?"

It had been so lovely, she now realized, to know absolutely what she must do. Now, all her certainty bled away, and left only confusion behind.

That phase lasted for a moment. Then the current of her drunken altruism launched itself in a new direction. A new certainty filled her. She lunged across the table and tore the pad from her father's wrist.

He didn't resist. Gently, respectfully, he removed her pad as well.

The yellow-robed monk bowed, his Friendship logo glinting in the candlelight. She and David returned the bow, and followed the old monk to the far end of the chapel. They sat cross-legged beside him on meditation pillows.

Perhaps twenty feet away, a bronze sculpture of two clasped hands rose from a simple altar. The sculptor had done a beautiful job—the two hands seemed to swoop out of infinite space and meet in a world made real by their meeting. Two young men in the robes of novices kneeled before the altar, and imitated its gesture with their own extended hands.

"Have either of you ever sworn Eternal Friendship before?" the monk asked his lay visitors.

Susan looked questioningly at David.

"I have," David said. "But never with so much feeling."

"I haven't," she said. "I never found someone I wanted to do it with. Or who wanted to do it with me."

Susan noticed that the young monks at the altar had edged a little closer, and that two new monks had joined them.

"My friends," the old monk said, "I am honored to help on your first step toward true life. In business, you form a partnership that lasts as long as the business makes money. In long-term romance, you make a four-year commitment. In Eternal Friendship, though, the bond endures forever. In Eternal Friendship, we find life's true meaning. In Eternal Friendship, we become truly human. Listen, and I will chant the vows."

Susan closed her eyes, and let the monk's words fill her heart. He spoke in a resonant monotone, punctuated by occasional shifts in pitch, much as Benedictines had once chanted their liturgy.

"To maintain your connection even if the other's company no longer delights you, and all your common interests wane.

"To hold your home always open if the other needs a roof and a bed, no matter how long that need lasts.

"To care for the other in old age, when he cannot care for himself."

The monk clasped his hands at his heart. Still chanting, he asked, "Are you ready to take these great vows?"

Susan heard a shuffling noise, and looked up from the old monk's lined face. At least twenty novices had gathered by the altar, all in pairs. Most of them maintained at least the pretense of prayer, but their frequent sidelong glances betrayed a more urgent interest.

The old monk sighed. "Excuse me," he said. He stood up and faced the novices. "My young Friends," he said, "are you still so shallow in your understanding of Friendship that you allow celebrity to fascinate you? I had hoped you'd gone beyond that."

He held a stern expression for several seconds, and then allowed an indulgent smile to flicker across his face. In a friendly tone, he added, "Of course, if I were your age, I couldn't resist catching a glimpse of Susan and David Frazier either."

He returned to his lay visitors and shrugged. "They're young. Would you mind if they asked a few questions? Then I'll send them away."

David looked at her.

"I'm okay with it," she said.

One junior monk shyly raised her hand. With a start, Susan recognized David's receptionist. The old man pointed and she stood up.

"Dr. Frazier," she said to Susan, "From your knowledge of history, do you think the world should use the discovery you and the other Dr. Frazier made? Don't you think it would be better to keep on going the way we are, instead of turning back the clock? From your knowledge of history, I mean. Sure, we've lost something, but don't the benefits outweigh it? Is familial love worth the return of countries and religious groups and ethnic groups, and all those hateful things? Do you ever wish you'd kept your discovery a secret?"

"I honestly don't know what the world should do," Susan said. "I'm as eager as you to see how the vote goes. Whatever the world decides to do, we'll all share the responsibility for it." She glanced fondly at David. "We couldn't take that responsibility ourselves."

Another hand rose, and then another.

One young man asked whether the attachment of a mother to her child, or a brother to his brother could remotely compare to the deep bonds of Friendship. Susan explained that in the past, people had considered blood relationship the strongest bond of all, and at that the novices burst into laughter.

Another novice asked how countries differed from anthills, and wondered whether patriotism should be considered an illness, like drug addiction. Susan said she thought that might be true, but she didn't really know. Perhaps the world should give the gene back to a small set of experimental subjects, and see how things went.

After perhaps a dozen questions, and some heated discussion, the old monk finally asked the novices to leave so that he could complete the ceremony.

He waited until the noise died down, and waited several minutes more in silence. Then he intoned the vows six times. When the words seemed engraved on her heart, he stopped chanting, and led Susan and David to the altar. He made them kneel, and chanted the vows a seventh time.

In her soul, Susan prepared herself to make this bond, this previously unimaginable connection, this relationship that she could not ever break, no matter how she changed, no matter what she felt.

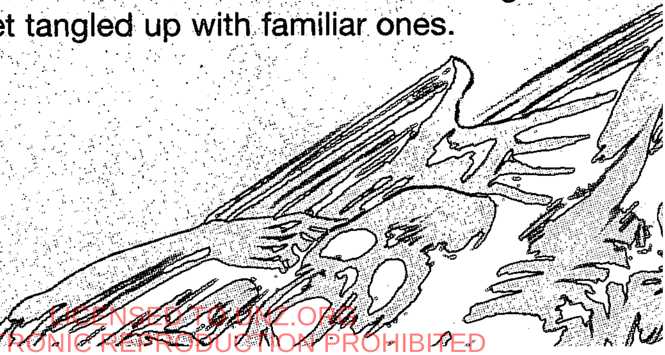
Whatever the world decided, Susan realized, she'd never be entirely alone again. ■

Inversus

Alec Nevala-Lee

Illustration by John Allemand

Unfamiliar phenomena can be even harder to figure out if they get tangled up with familiar ones.



The first curious thing happened around midnight.

Hammond was writing, just improvising at the keyboard to fill the blank expanse looped around the roller of his old-fashioned Hebrew typewriter. The keys clattered from right to left across the page. In the mirror above his desk, he could see the reflection of the clock on the bedside table.

"*Humpty Dumpty was sitting, with his legs crossed like a Turk, on the top of a high wall,*" he typed in Hebrew, frowning as he chose each word. "*A high wall—such a narrow one that Alice quite wondered how he could keep his balance—*"

A muffled crash came from downstairs. He heard it between keystrokes: just a single grace note slipped into the chattering melody of the typewriter. He barely noticed it, but it lodged in the back of his mind anyway, leaving a hint of uneasiness.

Hammond stopped typing and listened. Around him, the house stretched warm and dark, rain sluicing down the rooftop and rattling down the gutters as the thunderstorm outside charged the air with electricity.

He had almost convinced himself that he had imagined the noise when another crash came from below. It was louder this time, and it seemed to go on and on, as though an armful of dishes and silverware had been dropped down the stairs.

Hammond stood, his heart pounding quickly in his chest, and glanced down at the manila envelope on his desk. Tucking the manuscript under one arm, he looked over at the bedroom door. It was ajar.

He stood there for a minute, listening to the thunderstorm outside. All was silent downstairs. *This damn house is too big for me*, Hammond thought to himself. *Too empty, too lonely*. When he was working, he could usually convince himself that the solitude was a good thing, but not on nights like this.

He slipped on his shoes and opened the bedroom door. Downstairs, the sounds resumed more softly in the shadows: strange scraping and clinking noises, the faint ring of metal against metal.

Hammond descended, the steps creaking beneath his weight. At the foot of the stairs, he groped for the light switch. Overhead, the fixtures flared: the room grew bright, revealing the old furniture, the television gathering dust in the corner.

On some level, Hammond had expected the noises to stop as soon as the lights came on. They didn't.

The sounds were coming from the kitchen. Hammond took a breath and looked around for some kind of blunt instrument; bowing to convention, he pulled a poker from the fireplace. The kitchen door was closed. Between the door and the frame, he saw only darkness. The noise had settled into a quiet scraping.

Raising the poker, Hammond reached out to push open the door and realized that he was still carrying his manuscript in his left hand. He grasped the envelope more firmly, then used the tip of the poker to swing the door open.

Darkness. And the scraping sound. Hammond stepped inside and turned on the light.

A large pile of dishes had fallen off the counter onto the floor. Pieces of china littered the linoleum, crunching underfoot as Hammond stepped forward.

Hammond stood and looked.

A wine bottle was inching along the kitchen counter. It crept on its belly, its slender neck probing forward like a snout, slithering forward like an earthworm. He could read the label on the bottle, could even see himself faintly reflected in the smooth curve of green glass as the bottle hauled itself to the sink, scraping softly against the tile.

It paused for a moment, as if catching its breath, then slid forward six more inches. Then it paused again.

There was a pile of dishes and silverware in the sink, rinsed but not yet soaped. As Hammond watched, the wine bottle attached two plates to itself, touching them with the tip of its cork and fastening them to its back. The bottle began to flap the plates like wings. Hammond heard the rhythmic sound of clinking china.

The bottle flapped its new wings faster and faster until they became a blur, the clinking rising to an insectile buzz.

Then it took off.

Hammond ducked. The bottle flew over his head and circled the light above, its shadow weaving crazily around the room. After a moment, it stopped, hovering near the ceiling. Hammond ventured a look upward. He could see light through the glass, the wine sloshing inside the bottle.

The wine bottle looped around the light fixture and buzzed across the kitchen. Hammond flattened himself against the floor, craning his neck up as the bottle landed on the refrigerator and knocked over a pile of napkins.

It flew out the door to the dining room and was gone.

After a few seconds had passed, Hammond got to his feet and hefted the poker. His head was swimming. Idly, he kicked a broken plate out of his way and headed after the bottle, his manuscript still tucked under his arm.

The next room was dark. Hammond turned on the light, saw that the wine bottle was sitting on the dining room table, facing him.

Somewhere the bottle had found a corkscrew, which it had attached to its snout like a proboscis. The corkscrew was large and very sharp, a pointed helix of steel as long as a man's middle finger.

Hammond looked at the bottle. The bottle, it seemed, looked back—

—and flew straight for his head. Hammond shouted and fell to the ground. The bottle struck the wall where Hammond's forehead had been an instant before, driving the corkscrew half an inch into the plaster. It stuck. The bottle flapped the plates in a frenzy, struggling to free itself. Hammond rose on unsteady legs, wielded the poker and swung it just as the bottle managed to pull itself loose.

He missed the bottle but chipped one of its plates, sending it into a tailspin. The bottle smashed into a china cabinet and fell to the rug, stunned. A moment later it righted itself and flew towards Hammond a second time. Hammond swung the poker and missed again: the bottle darted past him, pivoted in mid-air and bore down like a dive-bomber, the tip of the corkscrew gleaming in the light.

Hammond ran. He turned and sprinted back to the kitchen, almost slipping on broken dishes, then wheeled towards the kitchen door. He got out and slammed the door behind him, but the bottle slipped through. He swung the poker, hit the bottle a glancing blow, then turned and saw his front door. Without thinking, Hammond sprinted across the empty living room, grabbed the knob, flung open the door and found himself on his own front porch. He pulled the door shut behind him.

The wood around the hinges splintered. The door caved in, almost breaking, and the house shook on its foundations as something enormous hurled itself against the barrier again and again. Not the wine bottle, this time, but something bigger—

Hammond staggered back from the door, the poker falling from his hands. Rain poured down, drenching him. He ran as fast as he could through the storm, envelope still clutched in one hand.

Hammond heard the door give way as its hinges exploded into fragments. The door smashed against the side of the house as something roared out into the night. He did not look but sprinted down the street, almost blinded by the storm, aware of nothing but the great invisible shape at his back.

Hammond fell. He found himself tumbling down a flight of stairs that seemed to appear from out of nowhere, his hands scrambling for purchase, and landed on concrete, the wind knocked out of him. He lay there for what seemed like a long time. Above him hung a grimy ceiling. He was aware of nothing but his heartbeat and an aching pain in his side.

A face swam into Hammond's field of vision. "You all right? You took quite a tumble there."

An old man in a drab uniform was bending over him. Hammond's world cleared. He recognized the brown tiled walls, the dank smell, the turnstiles a few feet to his right. He had fallen into the subway.

And there was no noise. Nothing coming to get him. Only this station agent, kneeling with a look of concern on his harmless face.

A hallucination, he thought. *A dream*.

The station agent frowned, took Hammond's shoulder and shook him gently. "Hey, you sure you're okay? You could've busted your head open. Maybe you better walk around a little, to make sure nothing's broken. These slippery steps—"

Abruptly, the agent broke off. His eyes clouded, as if he were puzzling over an algebra problem that wouldn't quite come together.

Hammond drew back, startled, as the station agent slumped face down on the floor. The agent twitched once and was still. Hammond looked and saw that something had buried itself in the back of the man's head. Something with a carved handle.

He gripped the handle and pulled the object out. It was a corkscrew, slick with blood and brains.

Hammond stood up, looked around. A crowd had gathered. Hammond raised the corkscrew in bewilderment, gestured at the corpse at his feet. "I . . ." he began, not knowing what he was going to say. "I didn't—"

A camera flashed as a tourist took his picture. Still gripping the corkscrew, he ran, pushing his way through the crowd to the turnstiles, sprinting down to the platform and the trains. Hammond fled, not knowing from what, his heart thudding on the right side of his chest. . . .

Hammond stared out at Margaret Lime from the front page of the *Boston Globe*, his forehead flaring bright in the flashbulb glare, a startled expression on his face, a bloody corkscrew in his left fist. The headline: *SUBWAY AGENT KILLED WITH CORKSCREW, SUSPECT FLEES SCENE*. Skimming the article, Lime saw nothing that she didn't already know. She coughed.

"What do you think?" asked Nathan Huang, watching for the profiler's reactions.

Looks like a corker of a case, thought Lime, keeping the *mot* to herself out of a mistrust of her own comic timing. She handed the newspaper back to Huang. "Not exactly the perfect murder, was it?" she said.

Huang shook his head. "A tourist snapped that picture of Hammond just before he ran. Since Hammond lives just down the street from the subway station, identification wasn't too much of a problem."

"And when you got here. . . ?"

"We found it like this."

Lime looked around. They stood in Hammond's living room. The furniture was scattered, chairs and coffee table overturned, the television's picture tube imploded. Lab technicians stepped on broken crockery and china as they moved about, taking prints off everything that wasn't pulverized.

Lime shook her head. She was pale, tall, her dark hair gathered back in a ponytail. Her overnight bag, the one she kept packed and ready for unexpected assignments, was on the floor. She knelt, unzipped the side pocket, pulled out a legal pad.

"Let's go over what happened again," she said, uncapping a felt-tip pen.

Huang began to repeat the same story he'd told before. He was muscular and stocky, with the body of a serious rock climber; Lime noted the characteristic pattern of calluses across his hands. She knew that many Asian cops fell into a sort of exaggerated masculinity as a defense mechanism, even on so respected a beat as the detective squad.

"From what we can gather," Huang said, "Hammond slipped onto the arriving train without being noticed, then got off at the next stop. We fished the corkscrew out of a garbage bin at the Park Street station. It had his prints all over it, and it matched a bottle opener we found in Hammond's kitchen. Looks like they were part of the same set."

"And after he got off at Park Street?"

"Well, Hammond could have transferred, or caught a bus, or tried to vanish into the city. He shouldn't get far, though. His picture made it into the *Globe*'s early edition, then got picked up by the wire services. He's in every newspaper in town."

"What about relatives? Does he have family in the Boston area?"

"Only his former wife," said Huang. "They divorced two years ago."

"Do we know why?"

"Based on the court records, they couldn't have children. It seems Hammond suffered from sluggish sperm."

"Have someone track her down and talk to her. And keep an eye on her office and home."

As she spoke, she felt something sharp beneath her foot. She raised her shoe and found a piece of green glass. Other fragments were strewn along the floor, the remains of a wine bottle. The wine had soaked into the carpet, making a dark red stain like a Rorschach blot. Lime stepped over it.

On the second floor, the bathroom had been demolished, the mirror over the sink shattered into a spiderweb of lines. The door of the medicine cabinet hung askew from its hinges. Lime swung the door aside. There was a prescription bottle on a lower shelf. Lime picked it up. *Theophylline*, said the label.

"What's that?" Huang asked.

"It's a medication used to treat asthma." Lime put the bottle back and closed the cabinet.

"Looking for something in particular?"

"If you want to know something about a person's lifestyle, there are two places you always check," Lime said. "One is the medicine cabinet."

"And the other?"

"The bookshelf."

Lime went over to the bookcase in the bedroom, read aloud a few of the titles: *A Vindication of the Kabbalah*; *A History of the Hasidim*; the *Sefer Yetsirah*. She noted those down. There was a mirror hanging above the desk in the corner. It, too, had been smashed.

The mirror struck her especially. It seemed like a gesture of someone who was permanently lonely. "Why would someone put a mirror in front of his desk?" Lime said, mostly to herself.

"Henry Miller did," Huang said. "And there was another writer who wrote at a desk full of rotten apples. Writers do all kinds of strange things, sometimes."

"Hammond was a writer?" Lime asked.

"A translator. Most of the books on the shelf are his own work. Take a look at this, too." Huang pointed to Hammond's typewriter.

Lime leaned forward, saw that a piece of paper was curled around the roller with four lines typed in Hebrew. She snapped on a rubber glove, pulled the paper out. The rest of the page was blank.

"We called you in because there have been other cases," said Huang. "Two others last night, and one more the previous evening, leaving six people dead. Seven, counting the subway agent."

"Cases of what?"

"Of violent disturbances. When the uniforms arrive, they always find the houses trashed, the furniture overturned, the dishes broken, and everyone dead. In fact, this is the first time that the owner of the house wasn't killed outright. As far as we can tell, nothing of any value was ever stolen. It's just random destruction."

"Maybe the destruction wasn't as random as it seems," said Lime. "If somebody came to these houses intending to destroy a specific object, the easiest way to cover it up would be to vandalize everything else. Like dumping a body on a battlefield."

"That's one possible explanation," Huang said after a pause. "But there's one other thing."

A slide projector had been set up in the corner. Huang took a stack of slides from his pocket, then pulled down the shades, darkening the room. The projector whirred into life; a blur appeared on the opposite wall.

Huang fiddled with the focus. "Two nights ago," he said, "a patrol car responded to a report of a disturbance at the apartment of John and Rachel Blume, in Boston. When police arrived, the noises had stopped, but the Blumes were found dead, and every room in the apartment had been torn apart."

The slide sprang into focus. Lime settled into a chair and studied the bloodbath. Two bodies, badly mangled, lay in the middle of a confused wreckage. The headboard of their bed had been broken in two.

Click. The next slide showed a similar scene with a different couple. "Here we have Peter and Deborah Evans," continued Huang. "We found them last night, about two hours before the business with Hammond. Again, their home was demolished. All of the windows were broken. We found five or six kitchen knives stuck into the bedroom wall. The seventh was lodged in Deborah Evans's eye socket. Finally, an hour later—"

Click. A photograph of a house on fire. Firefighters and trucks in the foreground, the flames blazing up into the night sky. *Click*. The smoldering ruin, seen from the inside. Lime recognized a third bedroom, the two bodies badly burned.

"Trevor and June Richardson," said Huang. "Firefighters got the call around ten o'clock. Something in the kitchen caught fire, it seems. After they extinguished the blaze, they found the Richardsons, dead. Even in the ruins, they could tell that their house had been vandalized."

"Did they die in the fire?" Lime asked.

"No. The coroner found no evidence of smoke inhalation or asphyxiation. Their necks had been broken."

Lime looked at the carnage on the screen. "Jesus."

"You haven't heard the best part yet," Huang said. "These murders point to a pattern, yes. But the autopsies revealed something even stranger." He went to the next slide. "When we cut open John Blume, we found this."

Click. Blume's body appeared on a mortuary slab, his chest peeled back in three triangular sections, the ribs chopped away to disclose his inner organs. Lime peered at the heart, the lungs, the coils of the viscera. "What am I supposed to see here?" she asked. "It looks like a normal body."

"What?" Huang looked up at the screen. "Oh, hold on," he said. "The slide's in backwards."

Huang got up, pressed a button to retract the carousel, pulled out the slide and reversed it. *Click*. The photo of Blume's insides appeared again, the mirror image of what it had been before.

"You've got to be kidding," said Lime.

Huang grinned, savoring the moment. "You're the one with the background in pathology, right? What do you know about situs inversus?"

"It's a rare medical condition," Lime said, getting up to examine the picture more closely. "The human body is symmetrical on the outside, but asymmetrical on the inside. Usually the asymmetries follow a set pattern: the heart on the left, the liver on the right, the intestines coiling in a certain way. But in rare cases, someone will be born with his or her organs in the opposite of the usual situation. Heart on the right. Liver on the left. The mirror image of a normal body."

"In that case," Huang said, "it's strange that we should find this in John Blume. And it's even stranger"—*Click* onto a second autopsy photo—"that we should find it in Peter Evans, too. And it's downright ridiculous"—*Click* onto another cadaver—"that we should find it in Trevor Richardson as well. But that's what we found."

"Wait a minute. All of the victims suffered from situs inversus?"

"All of the male victims," Huang corrected. "The women, as far as we can tell, were normal in every way. Even so, the odds against this pattern arising by chance are astronomical. Situs inversus only occurs in something like one in every 25,000 births."

Lime felt herself warming to the puzzle. "And Hammond?"

"We've checked his medical records. Hammond was born with situs inversus, too."

"But what does situs inversus have to do with these deaths?"

"I was hoping you could tell me," Huang said, pulling a paperback out of his inside pocket. "You wrote the book on the subject, after all."

Huang tossed the book to Lime, who caught it easily. "Is this why you called me in?" she asked, glancing at the photograph on the back cover, the one with her made up to look like Susan Sontag in a white lab coat.

"Maybe I assumed that the author of *Profiles in Carnage: Medical Aspects of Serial Murder* could provide some insight into these killings."

"The title wasn't my idea." Lime tossed the book back. "So what are you expecting me to provide? A profile?"

"Any number of people could provide a profile. I want you to solve a problem," said Huang. "Situs inversus leaves no visible mark on the surface. Someone's insides may be reversed, their heart and lungs may be a mirror image of the usual structure, but you'd never know it from the outside. So how is our killer finding and choosing these victims?"

* * *

Climbing up from the subway into the vast polished cavern of South Station, travelers emerge beneath a striking work of public art. From the ceiling of the lobby hang several dozen sculpted objects, each about the size of a football, dangling like weights at the end of a plumb line.

These pieces, which seem to have been turned on a lathe, lack any obvious function. In shape, they suggest oil lamps. Hanging from their lengths of wire, they are noticed by few, if any, of the thousands who pass daily through the terminal.

Hammond spent over a minute staring at those hanging pieces, reminded of something that he couldn't quite put his finger on. Eventually, he shook his head and moved on, the familiar shape of those objects still nagging at him.

Most likely, he was just exhausted. He had spent most of the night riding the subway, changing at random from train to train, focusing on nothing but the rush of the tunnel and the rumble of the wheels underneath his feet. The plain fact was that he had nowhere to go. His world had consisted of his typewriter, his desk, his books, but that world had been demolished, and his last few threads of human connection had been cut long before. He was alone, so he just rode the trains, hoping for his head to clear.

It had not. Memories of what had happened continued to plague him. Finally the early edition of the *Boston Globe* had appeared on the street, the front page branding him a murderer.

Time to get away from the city, he had thought.

Slipping into a drugstore, he'd bought a pair of sunglasses. Now he stood in the lobby of South Station, a lone figure among the coffee shops and flower kiosks. Through the lenses of his sunglasses, everything seemed dark, like the hazy substance of a dream.

He rushed past the newsstands and arrived at the ticket counter. "One coach ticket to New York City, please," he said.

"Sixty dollars," said the ticket agent.

Hammond fished out the money and waited for the ticket to print. Eventually he realized that the ticket agent had noticed his sunglasses. "Having trouble with your eyes, sir?" she asked.

I've been seeing things, that's all, Hammond thought to himself.

He took his ticket and turned away, glancing up at the enormous clockface on the opposite wall. An hour until his train. Until then, he had to stay invisible. He slipped the ticket into his pocket, adjusted his sunglasses and decided to spend the next two hours in a stall in the men's room.

As he moved toward the restroom, an abandoned copy of the *Globe* caught his eye, lying on a table in front of a coffee stand. His photograph was on the front page. He paused, despite himself, and looked at the picture again. If it hadn't been for the photo, he might have been able to convince himself that it had all been a fantasy. Even the article itself might have been explained away. But Hammond couldn't argue with the photograph. What had happened to him last night had been real. The noises. The wine bottle. And that invisible shape crashing through his front door.

Scanning the front page, he saw a second headline, in an unrelated article at the bottom of the page. As soon as he read it, he felt as though a cold fist had socked him in the stomach:

UNEXPLAINED KILLINGS LEAVE SIX DEAD IN BOSTON.

Names and faces jumped out at him. Peter and Deborah Evans. Trevor and June Richardson. John and Rachel Blume. Their houses torn apart. The inhabitants found dead. The other details were uncertain, but the male victims had all suffered from situs inversus. The article failed to attach any importance to that fact, but Hammond knew better.

Things are crossing over, he thought.

Others had died, murdered by the same force that had driven him onto the street. That made things difficult. If he fled now, the danger might grow, with no one left to stop or understand it. Because he knew what was happening, didn't he?

Hammond glanced down at the envelope in his hands, swallowed hard, and pulled out the manuscript. It was about a hundred pages long, in Hebrew.

It would be easy to destroy. Get a pack of matches at a drugstore, find a garbage can in some deserted alley, toss in the pages and have a bonfire. Hammond looked around, stuffed the manuscript back into the envelope and took a breath. He calculated how much time he had left, began to look for the exit—but something stopped him first.

A few yards to his left stood a florist's kiosk. It was stocked with bouquets of roses, daisies, tiger lilies. The flowers were wrapped in plastic, sitting in black vases with labels like *Nature's Garden*, *Fall Bounty*, *New England Sunset*. There were thirty or forty vases in all.

As Hammond watched, all the flowers turned around to look at him. Their stems twisted in place, the leaves brushing softly against one another as their blossoms pivoted in his direction. The cellophane of the bouquets crinkled.

Closest to him was a tiger lily. As he stared, the flower bowed its drooping head twice, then gave a quick nod to the left.

Hammond turned. Across the lobby, a security guard was heading towards him. Scanning the terminal, he saw two others, both wearing black parkas, slacks and neckties. There was no mistaking it.

Hammond looked back at the flowers. The tiger lily nodded again.

Then the flowers began to wilt, their petals shriveling and falling off before his eyes.

"Okay," Hammond said.

He glanced across the terminal. The escalator leading to the subway was one hundred yards to his right. The security guards were almost on top of him. Hammond could see their faces now. They were not smiling.

Hammond clutched his manuscript and set out across the lobby. Around him, passengers waiting for the trains milled across the echoing tile. He moved past redcaps wheeling luggage carts, keeping his eye on the escalator. Seventy yards to go.

Were the guards still closing in around him? He chanced a look over his shoulder, couldn't see anything at first, finally noticed a man in a black parka thirty feet to his left, still approaching, but—

Hammond tripped over a luggage cart and collided with a redcap. He apologized, climbed over the suitcases, saw that only fifty yards stood between him and the escalator. He began to walk more quickly.

"Sir? Could you wait a moment, sir?" The voice came from over his left shoulder. Hammond ignored it. Thirty more yards. Blood pounded in his temples. The sound of his footsteps clocking against the floor rang in his ears as he abandoned all pretense and broke into a run.

"Stop, sir!"

The sound of a pistol cocking. Hammond froze.

"Turn around slowly. And put up your hands."

Hammond turned. A security guard faced him, his pistol drawn. The guard was about fifty years old, his hair cropped short.

"You're making a big mistake," Hammond said.

"Get on your knees," the guard said.

Hammond knelt, his eyes locked with the guard's eyes, his stomach churning. "You need to let me go," he said. "I need to stop this myself. Something's trying to kill me, because of my book. . . ."

A loud rattling came from above. Hammond looked up and went white. Directly above him hung those dark sculpted objects, those smooth decorative pieces so suggestive of oil lamps.

Now they swayed violently on their lengths of wire, whipsawing like irregular pendulums.

The security guard glanced up. At that moment, one of the pieces dropped from the ceiling. It hit the guard in the middle of the forehead, knocking him down. His pistol went off with a bang, shattering a window.

Hammond rose as the pieces fell all around him, colliding sharply with the tile. Even after they fell, the pieces continued to move: righting themselves, waddling forward on their circular bases, crowding around the security guard. The pieces started to nuzzle the man's prone body, pressing in like a flock of penguins, wobbling unsteadily across the floor.

At that moment, Hammond knew.

As he turned and ran down the escalator to the subway, he understood why the objects had seemed so familiar to him, so disturbing, so maddening.

"They look like chess pieces," Lime said.

The area around the escalators had been cordoned off. Lime and Huang stood scrutinizing the fallen pieces of sculpture that littered the floor of the terminal. "What's that?" Huang asked.

Lime knelt, picked up one of the fallen sculptures. "They look like chess pieces, don't they?" She thoughtfully weighed the object in her hand. "I'm not precisely sure what happened here," she finally said.

Huang pulled out his notebook. "I think we've got most of the story. Hammond took the subway to South Station and tried to purchase a ticket to New York. The clerk recognized him from his picture in the *Globe*, which had been posted behind the counter, and called security after she sold him the seat."

"And then?"

"This is where it gets strange. You see these things on the floor? It seems that when the security guard approached Hammond and tried to arrest him, these pieces began to fall from the ceiling. One of them clocked the guard right on the head. Knocked him out. Hammond ran back to the subway and escaped in the confusion."

Lime looked up at the ceiling. "The pieces just started to fall?"

"We don't know how it happened."

"Did Hammond say anything to the guard?"

"Yes." Huang turned to the relevant page in his notebook. "*Something's trying to kill me, because of my book.*"

"His book." Lime pulled a newspaper clipping from her pocket, smoothed it out. She pointed to the photo of Hammond with the corkscrew. "Look here. What do you see in his hand?" she asked Huang.

"A corkscrew," Huang said.

"No," said Lime. "I mean, his other hand."

Huang looked. The photograph had been cropped at one edge, but he could still make out a flat rectangular object. "A manila envelope?"

"A manuscript." Lime repocketed the clipping. "Hammond was a translator. Do we know what he was working on?"

"A translation into Hebrew, based on what we found in his typewriter," said Huang, opening his notebook again. "*Humpty Dumpty was sitting, with his legs crossed like a Turk, on the top of a high wall—such a narrow one that Alice quite wondered how he could keep his balance—*"

"Wait a minute," Lime said. "That's from *Through the Looking-Glass*."

"In Hebrew," said Huang.

"That's rather suggestive, don't you think? We've got someone killing people whose insides are the mirror image of a normal human body, and one of them is busy translating Lewis Carroll into Hebrew?"

"You're saying that these killings have something do with the Alice books?"

"I'm not saying anything yet. But all the signs point to a fetishistic serial killer, someone targeting people with situs inversus for some ritual or psychological reason. . . ."

"Such as an obsession with *Through the Looking-Glass*?"

"It wouldn't be the oddest psychosis ever to trigger a killing spree."

Lime looked down at the oversized chess pieces on the floor, nudged one of the pieces with the toe of her boot.

"I'm not saying that Hammond is the one behind these murders," she said. "But we can bet he knows more about them than we do."

"*Next stop, Boylston.*"

Hammond sat in one corner of the subway car, the manila envelope on his lap. Behind his dark glasses, his eyes were closed. He heard the doors slide open as the train pulled into the Boylston station, then braced himself a moment later as the doors closed again and the train surged forward.

Hammond felt safe here. Although he knew, on some level, that the police would be focusing their search on the subway stations, he continued to ride the trains. Something about the rhythm seemed to cool the pressure on his brain.

Straightening up, Hammond slid his translation of *Through the Looking-Glass* from its manila envelope. He glanced from chapter to chapter, scanning the text for a clue, a solution.

He came to one of his favorite moments in the book, where Alice wonders if looking-glass milk would be good to drink. The answer, Hammond remembered, was no. In chemistry, there are some substances that are mirror images of one another, right- and left- handed versions of the same complex molecule. Most organisms can digest only one handedness of any given chemical. Lactose, for example. Add bacteria into a solution of right- and left-handed lactose molecules and they consume the right-handed ones, leaving the left- handed ones untouched.

Hammond imagined a similar predator feeding on a human population, leaving most men and women alone, devouring only those whose bodies, like his, were reversed on the inside. A looking-glass creature that fed on looking-glass people.

He put his hand over his right breast and felt his nervous heartbeat. As a child, he had realized that his situs inversus made him different from other people. Ever since then, he had felt a certain kinship with the looking-glass world. It had led him to Lewis Carroll's books, to mirrors, even to a better understanding of Hebrew. A looking-glass language that ran from right to left across the page.

It was this last thought that frightened him the most. The kabbalah taught that a text is like the human body, with its own system of organs and limbs. Each letter matters. The choice of a single character can affect the entire organism, and can mean the difference between a routine translation and a powerful magical tool, one that can invoke demons, or create life out of nothing.

But what, precisely, had he invoked by translating *Through the Looking-Glass* into a looking-glass language?

And how could he push it back the way it came?

On the wall across from him was a poster of the Boston skyline. As Hammond gazed at the picture, looking at the images of clouds and skyscrapers, the answer came to him in a sudden inspiration.

He looked at the map of stations on the wall. At the next stop, he could transfer and retrace his steps, riding the subway car to his final destination. Hammond slipped his manuscript back into its envelope, waited for the train to stop, and then stepped out onto the platform.

Heading for the turnstiles, Hammond passed a stand selling newspapers and candy. A television on a shelf above the magazines was turned to the local news, where a reporter was broadcasting on location. On the screen, a house with broken windows was visible over the reporter's shoulder. Crime scene tape was stretched across the sidewalk; police officers and detectives were milling around the yard. Hammond almost passed by the stand without pausing, but a comment by the onscreen reporter stopped him brutally short:

". . . declined to respond," the reporter said into the camera, "but reports indicate that the victim, an unemployed engineer named Leonard Roth, suffered from the condition known as situs inversus, a rare medical syndrome characterized by. . . ."

Hammond stared at the television screen. He didn't recognize the house or the neighborhood, but the destruction was all too familiar. As he watched, the image on the television pushed into the front door of the house, tracking an Asian detective and a tall, pale woman as they stepped inside.

Another victim with situs inversus, he thought. *It's happening again.*

Hammond turned away from the television, sickness rising in his stomach. There was a row of phones next to the magazine stand. Hammond hesitated for a moment, then strode over to the nearest telephone and grabbed the receiver.

Lime stepped into Leonard Roth's bathroom and turned on the light. The bathroom was dim, the shower curtain speckled with mildew, the mirror of the medicine cabinet smashed.

She and Huang had received the news just over an hour ago. This time the attack had occurred in daylight, in Somerville, in full view of the entire neighborhood: a neighbor had seen the windows of Roth's house smashed from the inside and had called the police, who had found Roth lying dead on his living room sofa, a deep wound dividing his chest. An attentive medical examiner had noticed that Roth's heart was on the wrong side of his body, and the uniforms on the scene had drawn the obvious conclusion.

"This isn't going to stop," Huang said, stepping into the bathroom after Lime. "And it looks like our killer is becoming more brazen, more assured."

"But the timing seems to clear Hammond," said Lime, opening Roth's medicine cabinet. "There's no way he could have made it from South Station to Somerville in time to kill Roth."

"I don't know about that. Destruction on this scale has got to be the work of a gang of at least two or three people. One man couldn't do this by himself."

"You're right. Especially if he was asthmatic, like Hammond." Lime paused, running her eyes along the medicines on the lowermost shelf. "Or Leonard Roth," she said.

"Excuse me?"

"Look." Lime pointed to several inhalers lined up like toy pistols, and a bottle of pills. *Theophylline*, said the label. The same medication she'd found at Hammond's house. "Some of these medications match the ones in Hammond's bathroom," Lime explained. "It looks like both Hammond and Leonard Roth were asthmatic, or maybe suffered from lung infections."

"Is that important?"

"It might be. We're looking for connections, right? If the victims all used the same medication, it might mean something."

"I checked Hammond's medical records when the situs inversus connection first came up, and I didn't see anything about asthma or lung problems. The way he ran from the cops in South Station didn't make him look like an asthmatic, either. But we'll get the bloodwork from the other victims soon, if you want to check for other traces of the drug."

"It could just be a coincidence," Lime said, slipping the medication into a plastic bag. "Or it could be that someone is finding victims through records of their prescription drug purchases."

"Why would someone do that?"

Lime was about to respond when a uniform approached them with a cell phone. "You'd better take this call," the uniform said. "It's a 911 operator. She says that she's got Hammond on the line."

"Where is he?" said Huang.

"He's calling from a pay phone in the Park Street subway station. Security is on the way."

"Give it to me." Huang pressed the speaker button on the phone so that Lime could listen to the call. "This is Detective Huang."

"Detective, I've got someone on the other line claiming that he's being chased by the police for that corkscrew killing," the operator said. "He wants to talk to someone in charge of the investigation."

"Put him on." Huang glanced at Lime. "I'll do the talking," he said.

A moment later, a man's voice came over the phone: "I didn't kill that subway agent."

"Is this Gerald Hammond?" said Huang.

"I didn't kill him," said the voice, without a pause, "but I know what did. You aren't looking for an ordinary murderer. You have to listen to me."

"I'm listening."

"Something is chasing me," Hammond said. "I'm calling to tell you that I'm the only one who can stop this. If the police try to interfere, more people will end up dead."

"Hammond, we can protect you."

"Not from this. Not from what I'm up against. . . ."

"Does it have to do with your translation?" Lime asked suddenly. "Does it have to do with *Through the Looking-Glass?*"

Silence on the other end. Huang glared at Lime, seemed about to speak when Hammond finally responded. "What do you know about that?" he said.

"I want to hear it from you," said Lime.

Another long pause.

"The kabbalists were on the right track," said Hammond. "I don't know how it happened. I didn't mean to do it. But something crossed over last night. Maybe it was my translation; maybe it was something more. But it confirmed something that I've suspected for my entire life."

"What's that?" Lime asked.

"The looking-glass world exists," said Hammond.

"Wait a minute," said Huang. "Hammond?"

Silence on the other end of the line, and the faint sound of the train station. A minute passed. They heard footsteps, the clank of a receiver banging against the side of the pay phone, a male voice that neither Lime nor Huang recognized. "MBTA security," the voice said. "Who is this?"

"This is Detective Nathan Huang. Where's Hammond?"

"There's nobody here. The receiver was off the hook."

"God *damn* it," said Huang. He handed the phone back to the uniform, turned to Lime. "He slipped away."

Lime had an abstracted look on her face. "The looking-glass world," she said.

Huang was fuming. "Why did you have to bring that up, anyway? Either Hammond's crazy or he's laying the groundwork for an insanity defense, with your assistance."

"He certainly seems deluded," Lime said. "But maybe it's a structured delusion. Maybe we can use his own brand of logic to catch him, to figure out where he's running."

"Do you think he gave us anything useful?"

"He gave us something to work with, at least. Hammond translated *Through the Looking-Glass* into Hebrew, right? When written, Hebrew goes from right to left across the page. It's a looking-glass language."

Huang was looking at her oddly. "All right."

"And it's a language with a rich tradition regarding the power of the written word. The ancient kabbalists believed that the letters of the Hebrew alphabet were the tools that God used to create the Universe. If you combine the letters in the right way, you can make things happen."

"Is that what you really believe?"

"It doesn't matter what I believe. I'm trying to figure out what Hammond might believe. You brought me in to profile, and I'm profiling. You saw the books he translated. Studies of the kabbalah, of Jewish mysticism. Hammond was immersed in this tradition. Maybe he started to believe it himself."

"To believe what?"

"Legend has it that the kabbalists used the Hebrew alphabet to summon spirits and angels," Lime said. "Maybe Hammond believes that his translation is doing the same thing. He accidentally stumbles across the right combination of symbols, and something destroys his house. He runs, manages to make it into the subway. But something catches up with him at the train station, and he needs to run again, convinced that a looking-glass creature is trying to kill him."

"So he's crazy."

"Probably."

"But where does that leave us?"

"Remember what Hammond said to the security guard? *You need to let me go*, he said. *I need to stop this myself.* He's going to stop running soon. He'll seek out his demons. Hunt them down. But how do you hunt a looking-glass creature?"

Huang lifted his hands. "I don't know. Find a really big mirror?"

"Right," Lime said, and froze.

Park Street, she thought to herself. *Only a few stops from Copley Square*. The missing piece fell into place, and its obviousness astounded her.

"I know where Hammond is going," she said.

"You do?"

"You were absolutely right." Lime headed for the stairs. "To hunt a looking-glass creature, you look for a mirror. You find the biggest mirror in all of New England and wait for your quarry to come for you, so you can push it back through the goddamned looking-glass." Lime grinned. "Hammond will head for the source, for the greatest looking-glass of them all. He'll head for the Hancock Tower."

An hour later, in Copley Square, a man wearing a blue jogging suit emerged from the revolving doors leading into a hotel lobby. He hesitated for a moment on the sidewalk, looking across the way at the intricate face of Trinity Church, and pretended to study the saints and gargoyles carved into the stone.

The John Hancock Tower rose above the square, an enormous parallelogram, its sides shimmering with the reflected light of the afternoon. Sixty stories high, mirrored on every surface, it gave back an image of Boston as it existed in that other world, a looking-glass city, perfect down to the smallest detail. Ten thousand panes of silvered glass. The largest mirrored skyscraper in New England.

A moment later, the jogger was followed by a third figure; soon after that, a fourth. They headed for the park across the street and began to spread out, wandering with apparent aimlessness through the rows of green benches beneath the blossoming trees. Kids played around them, toddlers chasing their parents along the cobblestones, squealing in their tiny parkas. The sky above was brilliant and blue.

The figures watched the crowd.

One of these figures was Lime. Hands deep in her pockets, she gazed around the park. It was bounded by the church on one side, a library on the other. To her right stood a fountain in the shape of half an octagon, a pair of obelisks framing the view of Boylston Street. In front of the fountain stood bronze statues of a tortoise and a hare.

To her left, the mirrored prism of the Hancock Tower stood against the sky. Across from the tower stood the convoluted brown facade of Trinity Church, planted in perfect symmetry with its reflected double across the street.

Looking around the park, Lime silently pondered the net that was being drawn around the square. Four FBI agents on foot. Two more stationed on the observation deck of the Hancock Tower with radio and binoculars. Four cars parked on side streets, one for every possible direction of pursuit. The FBI calls it the floating box method.

All that remained was to wait. Lime watched a couple of kids playing on the bronze tortoise, laughing and slipping across the smooth shell. The tortoise had a grin on its face. Behind it, the hare scratched its ear in puzzlement.

She heard a clink of keys behind her and turned around. It was Huang, a sheaf of papers in one hand. "We've just received the blood results from the first six autopsies," he said. "Remember that asthma medication, theophylline? They found it in John Blume and Bill Evans, but not in Trevor Richardson or his wife. No other drugs in any of the victims. No trace of poisoning or sedation."

He handed her the folder. Lime opened it, trying to conceal her frustration. The connection she had been hoping for had failed to materialize. She skimmed the breakdown, flipping from one report to the next.

"See anything?" Huang asked.

Lime closed the folder. "I don't know."

"You seemed a lot more confident when you assembled this surveillance team," said Huang.

"I'm just following a hunch."

"Hell of a hunch. From what I can see, there's no evidence that Hammond is headed for the Hancock Tower."

Lime tucked the folder under her arm. "Look around and tell me what you see."

Huang turned, humoring her. "The Hancock Tower."

"And what do you see reflected there?" Lime said.

"You and me."

"That's right. We're reflected there. So is everyone in the park, and the facade of Trinity Church, and the surrounding buildings, and pedestrians, and passing cars. This is Boston's looking-glass." Lime handed the folder back to Huang. "Sooner or later, given his fascination with the looking-glass world, Hammond is going to come here. I can't see how he could do otherwise."

Huang frowned. "I don't care for your reasoning. If Hammond thinks he's being chased by looking-glass creatures, won't he stay as far away from mirrors as he possibly can?"

"Maybe, but he's going to confront his fear at some point. When he does, he'll come here. He'll be drawn to the greatest mirror of all, a looking-glass enormous enough to swallow up the monsters that have been chasing him. He wants to *end* this, before anyone else gets hurt. That's why he didn't dare go to anyone he cared about. His former wife, for example. She lives here in Boston, but he didn't go to her, because. . . ." Lime trailed off.

"What is it?" Huang asked.

Lime opened the folder again. A germ of an idea was digging at the back of her brain. "You said that Hammond's marriage fell apart because he and his wife couldn't have kids, right?"

Huang consulted his notes. "Right," he said. "Something wrong with his sperm."

"*That's* the connection I've been looking for," Lime said.

"What do you mean?

"Children." Lime leafed through the coroner's report. "These victims were all married, healthy and young, but none of them had children. Why not? The husbands had situs inversus, and none of them had children, because—" Lime's eyes widened. A photo from a medical textbook suddenly jumped into her head. "Oh, hell."

"Excuse me?"

Memories of dissections, old lectures flooded back. "I must be blind," she said. "It's been obvious the entire time. The missing piece—"

"What?"

"The husbands all had . . . had . . ." Lime groped for the name and finally found it. "*Kartagener syndrome*. That's it. It isn't in their medical records, but that *has* to be it."

"What's Kartagener syndrome?" asked Huang.

"It's a genetic disease. It means that these men had defective cilia in their bodies."

"Cilia?"

"Microscopic hairs that cover certain kinds of cells." Lime began to pace around the square. "You'll find them in the lungs, sweeping the airway, and in the tails of sperm. People with Kartagener syndrome have a genetic defect that paralyzes the cilia. There are three symptoms. First, respiratory problems. Without working cilia, the lungs can't keep the airway clean, right? And judging from the coroner's report, at least two of our victims suffered from respiratory infections."

"All right."

The details were coming swiftly back. "The second symptom is male infertility. Without functional tails, sperm can't swim."

"And none of our victims had children," Huang said.

"Exactly. And the third symptom is situs inversus."

"Wait a minute. What do defective cilia have to do with situs inversus?"

"*It's how the body tells left from right.* In a normal fetus, organ placement is determined by special proteins that accumulate on one side or another of the developing embryo. Their distribution determines where the organs end up. Cilia guide the proteins from place to place, but if these cilia are defective, the proteins are randomly distributed. Organ placement becomes unpredictable, and half the time, the result is situs inversus."

"But why wasn't this syndrome listed in anyone's medical records?"

"The condition wasn't even defined until about twenty years ago. Their doctors probably never made the connection."

"Damn," said Huang. They were standing before the weathered face of Trinity Church. Gargoyles peered down from the eaves; the saints stood in high relief with open books in their hands. "So what does this mean?"

"I don't know yet."

"It's just one more mystery, then?"

"I'm afraid so."

"In that case, it doesn't bring us any closer to solving this case." Huang climbed the steps of the church underneath the overhang, then turned back toward the skyscraper. "This is all very interesting, Lime, but until we locate Hammond, I—"

He stopped, looking at the mirrored side of the tower.

Before them, the entire park was mirrored in the Hancock Tower, the building reflecting back an image of the square in reverse, throngs of looking-glass people strolling beneath the trees. Hammond was one of them. Huang spun, saw Hammond standing two hundred yards away, his hands in his pockets, thoughtfully examining the statues of the tortoise and the hare next to the fountain.

"We've got him," said Huang.

Lime turned to follow his gaze, sucked in air at the sight.

"How do you want to handle this?" Huang asked.

"You get on the radio," said Lime. "Tell them to get a car ready. I'll go after him alone."

"Why?"

"I have a better chance of getting close to him than anyone else," countered Lime. "I'm a woman, and I'm alone. We don't want to alarm him, do we? My hunch got us here. *I'll* make the arrest."

Swallowing his disapproval, Huang nodded and headed off. Across the square, Hammond seemed unaware that he had been noticed. He was wearing sunglasses, and an envelope was in his hands. High above the park, the sky was darkening. The wind blew cold.

Lime unsnapped the strap of her holster and moved in.

* * *

Hammond stood next to the two statues, brooding. He reached out and touched the tortoise's smooth bronze shell, felt the coolness against his skin. For the first time in many hours, he felt calm.

"Hammond." The voice came from behind him.

He turned. Facing him was a woman he did not recognize. "Yes?"

"Hammond, my name is Margaret Lime." The woman stepped forward. Her eyes were hard to read. "I'd like to talk to you for a moment. Do you mind?"

"No, I don't mind." Hammond glanced down at the tortoise's shell, examined the shapeless reflection of himself in the dull metal. "I would like to talk to someone. Do you have a wristwatch?" he suddenly asked.

"Yes," Lime said.

"Something will happen in about ten seconds," said Hammond. "Until then, we can talk."

Lime glanced nervously at the time, then looked back at Hammond. "How do you know that something is going to happen?"

Hammond wondered how to answer that question. After reaching the square, he had avoided the park for more than an hour. Then, finally, he had seen these statues, and his search had ended. The Hancock Tower had brought him here only to direct him to his true goal. It had been obvious. Now he said: "It's difficult to explain. Maybe it—"

He broke off as a loud creaking sound came from beside him.

"Too late," Hammond said simply.

They turned and looked.

Behind the tortoise stood the statue of the hare. It had been designed and cast several years ago, Hammond vaguely remembered, to commemorate the centennial of the Boston Marathon. Ever since the bronze had cooled, the statue had remained in the same position—the hare's rear leg raised to scratch behind one ear, its nose almost touching the ground.

Now a creaking rang out from within the statue, soft at first but steadily growing.

Hammond recognized it. It was the shriek of molecular bonds breaking, metal melting and rehardening on a microscopic scale. The rabbit remained solid on the surface, but the noise continued, welling up from deep inside the bronze, rising to an unbearable intensity. He wanted to cover his ears, but his arms wouldn't move. He could only stare.

Within the statue's core, changes were taking place.

One of the rabbit's ears twitched. Hammond could see the surface of the bronze stretching, distorting. The noise doubled in volume, redoubled.

The rabbit raised its head.

Hammond heard a splintering sound. The bricks paving the ground beneath the rabbit's right front paw were cracking, crumbling. The paw moved. It raised itself with arthritic stiffness, surface rippling with the strain, joints forming and flexing themselves before Hammond's eyes.

By now, some of the children in the park had noticed what was happening. He saw a little boy tugging on his mother's hand, pointing. The mother saw it, too.

The park grew hushed. Crowds of teenagers, tourists, parents came to halt. No one moved, watching as the statue come to life.

After four years of fruitless effort, the rabbit finally scratched behind its ear and lowered its right haunch. The metal groaned: the rabbit's leg twisted, bending to touch the ground, the bronze stretching like rubber in three or four places.

For a second, all was silent. Hammond allowed himself to hope, somehow, that things might be over.

And then the rabbit bounded up and away.

Its rear legs tensed and it tore itself out of the ground, sending shards of bricks flying. One of them hit Hammond in the face; he touched his hand to his cheek, drew it back bloody. The rabbit jumped and landed in the fountain with a splash. The concrete broke beneath the impact, cratering and splintering beneath the rabbit's weight.

Of course: this rabbit was the size of a big dog, and made entirely of bronze. It would leave footprints in the pavement as easily as a hare would leave traces of itself in the snow. Now it sprang out of the water, leaping easily between the two obelisks at the fountain's edge. As it jumped down onto the street, its rear legs chipped the concrete rim of the fountain, and it was gone.

Dropping his manuscript, Hammond ran after the rabbit. He jumped into the fountain, splashed toward the edge, climbed over. Throwing himself onto the sidewalk, he looked around desperately. The rabbit was bounding down Boylston Street, moving under the trees, scattering crowds of pigeons.

He sprinted after it. He could hear the crunch of its paws, saw the small crumbled divots that each leap left in the ground. The statue was moving fast. Already it was half a block ahead of him and pulling farther away, the lights of the city running along its bronze back as it ran. Hammond's lungs heaved cold air.

Behind him, Lime clambered over the edge of the fountain. She tore the police radio from her back pocket, yelled into it: "Get a vehicle down here! I can't keep up with this goddamned thing!" Lime clicked the radio off, sprinted down the sidewalk. Hammond was fifty yards ahead of her, the rabbit a hundred yards further away. Her shoes pounded against the pavement as she ran, weaving around groups of startled pedestrians.

Fifty yards up, Hammond was tiring. Almost a block ahead, the statue bounded past clusters of shoppers, sending gift bags and packages flying. Hammond realized that he wasn't going to make it. The blood pounded in his head. His feet slowed, the muscles in his legs fluttering with exhaustion.

He reached the corner of Boylston and Clarendon Street. Alongside the curb, a Toyota was idling at a red light. Hammond didn't even stop to think. He dashed around the front of the car, yanked open the driver's side door.

Inside, a woman looked at him: "What the hell?"

"I'm sorry," Hammond tried to say, but all his breath was gone. He only managed a whisper of air as he reached in and pulled the woman out of the driver's seat. She went sprawling on the asphalt, cursing and clawing at his face. Hammond ignored her, climbed behind the wheel and drove off.

Lime saw what was happening. "Shit!" She drew her pistol, ran with arms and legs pumping.

A station wagon pulled up beside her. Huang was at the wheel. Lime pulled open the door, slid into the passenger's seat.

"I can't wait to hear your explanation for this," Huang said, and roared off.

Ahead of them, Hammond peered through the windshield of the stolen Toyota, straining to see the statue. Finally he glimpsed it in the distance, leaping over a parked car. It landed squarely in the middle of the roof, collapsing it in a burst of breaking glass, then hopped on. Hammond prepared to follow it, then swore. Just up ahead, the traffic was at a standstill. He couldn't get through.

Not on the street, anyway. "This is a bad idea," Hammond said through clenched teeth, and drove onto the sidewalk. He honked his horn. In front of him, pedestrians dove out of the way. He hit a trash can with the front bumper, sending garbage flying.

Behind him, in the station wagon, Huang looked ahead and said: "Jesus. You want me to follow him onto the sidewalk?"

"Use your best judgment," Lime said, reaching for her cell phone.

"Who are you calling?"

"The surveillance unit in the Hancock Tower. I want them to figure out where this guy is headed."

She dialed. Just as someone answered, Huang pulled onto the sidewalk, horn blaring, and the phone dropped from Lime's fingers.

"Shit," she said, scrambling for it.

"I'd buckle up if I were you," Huang said, steering his way around a group of startled tourists.

Lime straightened up, phone to her ear. ". . . you there?" a voice was saying.

"Yeah, I'm here." Lime looked ahead. Half a block away, she could see the second car driving along the sidewalk. The distance between Hammond and the bronze rabbit was narrowing.

"Good thing this sidewalk is so wide," Huang muttered, swerving to avoid another crowd of people.

"What the hell is going on?" said the voice on Lime's phone.

"Why, we're in the middle of an old-fashioned chase scene," said Lime. "Listen, I want you to get our bearings, and tell us where this street leads." She shifted the phone to her other ear as the surveillance unit read off a compass bearing, which Lime repeated and wrote down. "And the street?" She looked out the windshield. "Oh, shit," she said.

"What?" said the voice.

"We're headed for a tunnel. I'm going to lose your signal."

Ahead of them, Hammond saw the orange light drawing closer as he approached the tunnel. The rabbit scampered only a few feet ahead of his front bumper. The metal of the statue was twisted out of shape, its haunches working back and forth as the bronze pinched and folded. The rabbit's ears were trembling. Hammond could see his headlights reflecting off the bronze.

"I've got you," he said.

Hammond pressed down on the gas and zoomed forward, closing the gap. The engine roared. Abruptly, the rabbit turned and headed toward the tunnel, feet crunching against the asphalt. Hammond followed it, pulling back into the street. Swerving around cars and trucks, he entered the tunnel. The sound of his engine echoed against the curved walls. The rabbit was two yards ahead of him. He was almost there. He floored it.

And then everything stopped.

In the middle of a leap, the rabbit turned back into a hunk of bronze. Hammond collided with it, the statue smashing against his front bumper, the car's hood crumpling. He slammed on the brakes, skidded and scraped against the wall of the tunnel, and came to a halt at one end of the pedestrian walkway.

Hammond killed the engine, climbed out of the car.

The statue lay on its side on the ground, steaming. The bronze had been twisted into an unrecognizable shape, but it was nothing but bronze. He kicked it. The metal was hot. There was a smell like something burning.

A pistol cocking behind him. "Hammond."

He turned. Lime and another figure stood with their guns drawn. Behind them, police cars pulled into the tunnel, sirens flashing.

"End of the rabbit hole," said Lime.

Lime held Hammond at gunpoint, her heart still pounding away. Listening to the sound of traffic bouncing off the walls of the tunnel, she thought of everything she'd seen so far. She thought of the statue coming to life. The chase. How everything had crashed to a halt right here, in the tunnel.

Huang reholstered his pistol, pulled out his cuffs. "What do you think, Lime? Shall we arrest this man?"

Lime nodded. Huang walked over to Hammond, looked down at the smoldering hunk of metal at his feet, then looked up at the fugitive's shaken features. "I'd be obliged if you'd hold out your hands for me," he said, with mock courtesy.

Hammond cooperated. His eyes were empty, dazed. Huang handcuffed him, read him his rights, and was about to lead him away when Lime spoke. "Just a second."

"Yes?" Huang was gripping Hammond by the back of his collar, one hand clamped to the man's forearm.

Lime reholstered her gun. "We can't take him out of this tunnel."

"What do you mean?" Huang looked at him quizzically. Hammond, too, seemed to stare.

Lime wondered how to explain herself, and finally decided to skip it. "My cell phone doesn't work in here," she said. "The signal died as soon as we entered the tunnel. But there's probably a security booth nearby, with a telephone."

"Yeah, I saw one on the way in," Huang said.

"Do me a favor and put in a call to the Boston field office." Lime rattled off a number. "Give them our location, and tell them to bring a Faraday truck to this tunnel. Got all that? We need them to send us a Faraday truck."

"What's that?"

"It's the bottle for this lightning bug." Lime nodded at Hammond. "We take him away in any other vehicle, and we run the risk of something . . . happening. Something like this." She pointed at the rabbit statue, which was quietly cooking the concrete beneath it. "As long as we stay in this tunnel, we'll be safe," she added.

Hammond finally spoke. "How do you know that?"

"Because I know what kept you alive all this time," Lime said. "I know why you didn't die right away, unlike everyone else involved in this mess. And I know what's been causing these events to happen."

"How about telling me, then?" said Huang.

"I'll need someone to make that call first."

Huang looked around, spotted an FBI agent standing nearby. "Agent! You heard the woman. Call the field office and get one of those Faraday things." The agent nodded and ran off. Huang turned back to Lime. "Let's talk," he said.

"Before we do that, let's take our prisoner somewhere else." Lime gestured at the chaos around them. Police had set up orange cones to divert traffic through the tunnel, but several dozen police, agents, pedestrians and bystanders were milling about the scene.

Huang turned to Hammond. "All right. Come with us."

They led Hammond to the station wagon and put him in the back seat. Huang slid in after him. Lime sat in the front, tilted the mirror so she could observe Hammond. "How are you doing?" she asked.

In the mirror, Hammond's eyes flicked up at him. "I'm hungry," he said. "And tired."

"Can we get on with this?" Huang asked. "I'm waiting for your explanation."

"Okay," said Lime. "I think that these events have something to do with situs inversus. More specifically, with Kartagener syndrome." She briefly repeated the three symptoms of the syndrome, and her conviction that each of the male victims in the case had suffered from it. "But there's more," Lime said. "This is a matter of speculation, but it's possible that Kartagener syndrome can also affect the nervous system."

"How?"

"The syndrome paralyzes cilia, the microscopic tails that lie on the surface of certain cells. Well, cilia are part of the cytoskeleton, the internal framework that gives the cell its shape. In brain cells, the cytoskeleton can also transmit impulses and information, and some scientists believe that it plays an important part in neural activity. We're talking about fundamental properties like consciousness and self-awareness, and even paranormal powers like psychokinesis, the power to move objects with one's mind."

Huang interrupted. "Paranormal? So you're saying—"

"—that it's possible that this syndrome affects the human brain in some way that we don't understand."

"You're saying that something triggered psychokinesis in these victims? I can't buy that."

"I know it's strange," she replied. "On the other hand, you and I just chased a bronze rabbit for three blocks down a busy city street. Occam's Razor doesn't exactly apply to situations like that."

"But—"

"And look at what happened at the train station. Those pieces didn't just fall by themselves, and I find psychokinesis easier to accept than the idea that Hammond opened a gate to the looking-glass world. Maybe it's all your own creation, Hammond," she said, turning to the man in the back seat. "Maybe all these things are your fantasies, born from your obsession with Lewis Carroll, actualized by a psychic power that arises only under certain conditions, in certain people."

Hammond was silent for a moment. The thought that the monsters chasing him might have been his own unconscious invention was hard to swallow. Finally he looked up at Lime and said, "But why? What caused these things to all happen at once?"

"I'm not sure myself," said Lime. "But there's one thing we can be certain about, something I didn't figure out until a few minutes ago. These episodes are being triggered by electromagnetic radiation."

"What makes you say that?" asked Huang, surprised.

"When we drove into the tunnel, two things happened, right? The rabbit turned back into a statue, and my cell phone died. I think there's a connection. Radio waves can't propagate down tunnels if their wavelength is too long. The walls absorb the waves, block them out. I think that whatever is causing these events is blocked in the same way." Lime looked at Hammond. "After you ran from your house last night, you went to the subway, right?"

"I fell into it, yes."

"But it meant that you survived the

first onslaught. Then, at the train station, when things began to happen again, you ran into the subway a second time. That may have saved your life. A subway tunnel blocks electromagnetic waves in the same way a tunnel like this one does. As long as you stayed underground, you were protected from radiation, but when you emerged, you started picking up the signals again."

"Signals from what?" Hammond asked.

"I don't know. It could be anything. Whatever it is, it's all around us, throughout the entire Boston area. It just passes through most of us, and its effects are invisible. But something about Kartagener syndrome sharpened your sensitivity to that signal and made its effects more pronounced."

Hammond looked grim. "Lucky me."

"You know, I'm something of a radio buff myself," said Huang. "And it's true that electromagnetic waves can have strange effects on the human nervous system. But even if these waves exist, we don't know where they're coming from."

"No," Lime said. "But until we do, we can still protect ourselves from their effects."

"How?" Hammond asked. "I don't want to stay in this tunnel for the rest of my life."

"You won't need to. I've requested a Faraday truck from the FBI field office. Usually the Bureau uses it to transport sensitive electrical equipment, but we're going to use it to transport you. It's an ordinary van that has been turned into a Faraday cage, a box that blocks most forms of electromagnetic radiation. It's covered with wire mesh and electrically grounded. As a result, it will shield you from all but the longest radio waves."

"And after it gets here? Where are you taking me?"

Lime glanced at Huang. "I don't know. Someplace underground?"

Huang shrugged, then looked out the window. "Is that our truck?"

Lime followed his gaze. A van with government markings had pulled up at the entrance of the tunnel. Its rear windows were silvered and covered in mesh.

"Looks like our ride is here, Hammond," Lime said. "Let's go."

The rear of the Faraday truck was badly furnished, with only a couple of plastic crates for seats. Shelves lined the inside walls of the van, but they were bare and sheathed in dustproof plastic. Lime stood holding onto the shelves for support as the vehicle made its way through the city. A partition separated the rear of the truck from the front, hiding the driver from sight.

Hammond sat on one of the crates, bouncing every time the van hit a dip in the road. The fact that his hands were bound made it difficult to balance. He looked across at Huang. "Would you mind loosening these cuffs?"

Huang glanced up at Lime. "I don't see why not." He told Hammond to hold out his arms, then fished a handcuff key out of his pocket, undid the bracelets.

"Thank you." Hammond sat back, rubbing his wrists. After a few moments, a thoughtful expression crept onto his face. "You know," he said, "there's something I've been wondering. Agent Lime?"

"Yes?"

"You say that these things I've been experiencing are all coming from my own mind. That I've been creating them myself."

"You might say that."

"In that case, Lime, how do I know that you aren't just a figment of my imagination?"

Lime grinned. "I can assure you that I'm not."

"Are you so sure of that? In *Through the Looking-Glass*, Alice sees the Red King in the woods, fast asleep. When she asks about him, she's told that he's dreaming, and that Alice herself is only a part of his dream. In fact, the entire world is part of his dream. And if the Red King left off dreaming about her, where do you suppose she'd be?"

Lime paraphrased from the book. "She'd go out like a candle."

"And so would the rest of the world." Hammond rocked with the truck, gripping the holes of the crate with his fingers. "We can never be sure that we aren't being dreamed by someone else, can we?"

"I suppose not," Lime said.

They drove on. Huang turned to Lime. "I've been thinking about this theory of yours. You're saying that there's an electromagnetic field spreading throughout the city, passing through all of us?"

"Right."

"Well, if that's the case, we should be able to trace it to its source."

"How?" asked Lime.

"By following the bronze rabbit."

On one wall of the truck was posted a map of Boston and the surrounding area. Huang stepped over to it and pulled a marker from his pocket. "I know something about ham radio," he said. "Radio enthusiasts use this principle to trace a broadcast. If you take a loop antenna and rotate it, you'll find that the signal is strongest when the antenna is at right angles to its source. That way, you can use the antenna to trace the signal."

On the map, Huang circled Copley Square. "If Hammond's nervous system is responding to some kind of radiation, the same principle should hold true. If you think about it, the brain has the same sort of symmetry as a loop antenna. You've got the right hemisphere and the left hemisphere, and both hemispheres get maximum exposure to a radio signal when you're facing the source straight on, right? And if Hammond's powers were strongest in one particular direction, any manifestation of those powers—especially a big, spectacular one—would naturally tend to follow that path."

"Like the rabbit statue," said Lime, realizing. "The statue will lead us to the source."

"Exactly. We know where the statue was headed from the readings taken by the observation tower, right? Now all we have to do is extend the line."

Huang took the marker and traced a black line across the map of Boston. Lime looked at where it led, and felt her heart jump in her chest.

Generating Facility, the map said.

"The line leads to a power plant," said Lime.

"What does that say to you?" Huang asked.

"It's obvious." Lime followed the trail with her eyes. "In any metropolitan area, the power grid is the single largest radio transmitter. We're constantly surrounded by an ocean of radio waves, but never realize it. High-voltage lines are like enormous antennas operating in a low-frequency band, the same as the brain and nervous system. Electricity does strange things to the brain. It can change the firing rate of brain cells, boost or lower the level of neurotransmitters. Power lines are no exception. If you plot a city's suicides on a map, you'll find that they tend to cluster around high-voltage wires. Maybe the same thing holds true for what we've been seeing."

"But why now?" Hammond managed to ask. "Why should these things just start to happen?"

"Maybe something changed," said Lime. "Any number of things can affect the power grid."

"Geomagnetic activity, for example," said Huang, taking the hint. "The aurora borealis. Or an electrical storm."

"That's right," said Lime. "Atmospheric current flows through transformers and power lines, slightly changing the electrical currents flowing through the power grid. A few nights ago—for some reason we don't know—maybe something changed and Hammond's brain responded. It was a tiny change, but maybe it was enough to affect certain highly sensitive people. . . ."

"People with Kartagener syndrome," said Huang.

"Right," Lime said. "But sooner or later, I wouldn't be surprised if the rest of us start to feel the effects."

It took a moment for the implications of her last remark to hit home. "Jesus," Huang said. "We have to warn the power company, tell them to shut the power down before anything else happens—"

"Right." Lime turned, was about to signal the driver to stop the van when a final thought came to her with staggering force. "Oh *shit*," she said.

"What?"

"Radio waves from the power grid are long waves. *Long waves.* A Faraday cage is useless against them."

"You mean—"

"This truck won't do any good."

Suddenly the van shook. It bounced once, twice. Lime almost fell to her knees, grabbed the shelves to steady herself.

"Are you doing this?" Lime asked Hammond.

Hammond's eyes were wide. "I don't know."

The ceiling of the van crumpled and began to pull apart, a seam appearing at the far end, then widening with a metallic groan. Chips of paint showered down. The inside bulb shattered in an explosion of sparks as the roof peeled back: looking up, Lime found herself face to face with the sky.

The van opened like a seed pod as the metal of the roof warped, twisted, spread apart. The shelves collapsed. The floor of the van folded beneath Lime's feet as the crack in the roof widened. Lime looked at Hammond, saw sweat beading the man's brow. "Stop it!" she shouted. "Gerald, stop this!"

Hammond stared at her desperately. "I wish I could."

Standing alongside her, Huang drew his gun. Aimed it at Hammond.

"This stops now," Huang said.

"You're right," Hammond replied.

The shelves splintered outward around them. Lime saw a piece of shelving strike Huang in the leg, driving him down. Something hit the back of Lime's neck, and blackness descended.

She was awakened by the sound of coughing. Her own.

Lime lay on the sidewalk, thrown clear of the van. She rose, felt the back of her head, and discovered an enormous lump.

She was at the side of the road. Ahead of her stood some industrial buildings, a wire fence. The Faraday truck sat to her right, in ruins. It looked like it had gone through a trash compactor: its windows were broken, the roof peeled away. Lime staggered over to the driver's window, peered in. The driver was unconscious, his face bloody.

"Lime." She turned. Huang was lying in the middle of the road, struggling to rise.

She went to his side. "Are you all right?"

He looked down at himself. "I think my ankle is broken. Give me a hand, will you?"

Huang slung an arm over Lime's shoulder, and she gently brought him out of the road. The detective sat down on the curb and winced. "Looks like I won't be doing any mountain climbing for a while, huh?" He made a face, then pulled a radio from the pocket of his overcoat. "I'll call for backup. You get Hammond."

"Do you know where he went?" Lime asked.

Huang stared at her like she was crazy. "Take a look behind you, and you tell me."

Lime turned and saw four terraced levels of concrete, a gigantic parking structure. Beyond it, she could see a building with a sloping skylight, a row of red doors leading into a central terminal. It was the Alewife T station.

"Call it a hunch, but I think he's probably headed for the subway," Huang said.

"Yeah," said Lime. "All right."

Lime stood, unholstered her pistol and looked at the station across the way. It was enormous. Any one of five floors might conceal her target, and she'd have to search them all.

Lime ran beneath the darkened overhang of the parking garage, moving past concrete pillars and heading down a ramp to the station itself. She reached the row of swinging doors, pulled one open, went inside.

She found herself in the lobby of the station. Corrugated concrete stretched above her. Brown tile rang beneath her feet as she ran past dingy shops and fast food restaurants to the center of the terminal. Fifty feet in, the ceiling gave way to a huge sloping skylight that stretched far above her head, transparent glass panels held in place by a scaffolding of white pipes. Ahead of her, an escalator chugged downward.

The station was empty. Somewhere downstairs, a street musician was playing, slapping his palms against an empty plastic drum. She swore to herself. Hammond could be anywhere.

Then she looked down.

A newspaper skidded along the floor of the terminal, complete with Hammond's picture on the front page. She put her foot down on the paper, felt it tugging beneath her shoe, struggling to get free.

The air in the terminal was perfectly still. There was no wind to blow the paper along. As far as she could determine, it was moving of its own accord.

Lime lifted her foot, freeing the paper. She followed it. The paper bounced along the tile, skipped lightly on one edge. Finally it rose into the air. It drifted upward, carried on an invisible draft, then disappeared over the ledge of the fourth floor.

Let's go, Lime thought.

She took the stairs, running up each flight two steps at a time. Below her, the drummer continued to pound out a nervous rhythm.

At the next floor, Lime found herself facing three escalators, all running down, with no staircase in sight. She looked up at the fourth floor and noticed that one of the big panes in the skylight had been broken. Papers, wrappers and other garbage were flying up to the broken pane and being sucked outside. Onto the rooftop.

She ran up the down escalator. At the fourth floor, Lime jumped off. She stood level with the skylight, which sloped for acres upward and downward. The broken pane was just a few feet away from where she stood. There was a narrow terrace on the other side of the glass, covered with gravel.

Hammond was there, staring down over the edge of the terrace. Around him, bits of paper and gravel and trash were rapidly swirling in a circle, wheeling and spinning in a mad dance. As Lime watched, more pieces of litter drifted up from ground level and were sucked outside, where Hammond stood at the center of the whirlwind.

"Hammond," said Lime. "Hammond!"

Hammond did not turn around. Either he was ignoring Lime, or the rush of the whirlwind on the other side of the glass made it impossible for him to hear.

Lime approached the skylight. Just before she reached the broken pane, the floor ended, terminating with a narrow railing. She looked down. The next floor was thirty feet below.

She looked back at the broken pane. If she could get through that opening, she could get out onto the terrace. Clearly, that was what Hammond had done. But how the hell had he done it?

Above him, a scaffold of white pipes held the skylight in place. Pigeons perched here and there on the grid. It was possible, Lime supposed, to swing onto the scaffolding, hauling herself up and climbing through the broken pane. But to get to the scaffold meant jumping out into empty space and grabbing onto a slippery handhold. One bad move and she would fall, and probably break her neck.

Not much of a choice, anyway, Lime thought.

Lime reholstered her gun, looked for the best place to jump. A horizontal pipe stretched four feet away. She glanced from side to side, then clambered over the railing and leapt out.

She hung in the air for an instant. Then she found herself hugging the pipe with both arms, her feet dangling over nothingness. She looked down, saw the drop beneath her plunge dizzyingly away. Her fingertips tingled.

"God," Lime managed.

She pulled herself up, clutching the pipe to the left of her, until she managed to stand, her toes dangling over the edge of the scaffold. Her heart clocked away, counting off tenths of a second.

Balancing carefully on her narrow perch, she climbed over to the ledge just below the broken pane. On the pipe above her a pigeon cooed and flapped its wings. Lime stared at it, then swung herself out onto the ledge.

She landed on the gravel.

The night air was cold. Hammond stood ten yards to her right, surrounded by a maelstrom of paper. Lime drew her pistol but did not point it. Her head was swimming from the effort of the climb. "Hello, Gerald."

"Hello." Hammond did not look up.

Lime eased her way to the edge of the terrace and looked down. The skylight continued to slope downward, a steep decline to a second gravel rooftop. Further away stood the upper level of the parking structure, rimmed with street lamps.

"Hammond, I'm too tired for this," Lime said. "Let's go home."

"I don't know if that's possible anymore."

"It's always possible." Lime extended a hand. "Just come with me, and I'll take you somewhere safe."

Hammond smiled bitterly. "No offense, Lime, but that's what you said last time."

He glanced over at her, saw the gun. Something tore the pistol from Lime's grip. She gave a start, fell backward. The gun hovered briefly in mid-air, cocked itself and joined the rest of the whirlwind.

"You wouldn't want to shoot me anyway," said Hammond. "Who knows? You might just be a part of my dream. If that were the case, if you killed me, you'd wink out like a candle. So would the rest of the world."

The vortex spun ever faster. Behind the whirlwind, Hammond's face was dull, empty. Newspapers, wrappers spun around: then the pistol, hanging for the briefest of instants above the edge of the terrace—

The hell with it, Lime thought, and jumped for the gun.

She caught it, newspapers beating against her face, the sound of the hurricane rushing through her ears. Her fingers closed around the pistol grip. Then she felt herself falling, tumbling down the long slope of the skylight. She rolled with gun in hand, trying to slow herself but feeling only glass.

Finally she struck the roof below, landing on her back in the gravel.

Lime caught her breath, looked up and saw Hammond standing in silhouette on the terrace above. She raised her gun, aiming to take Hammond down.

Her finger tensed on the trigger. The man was in her sights. For a split second, Lime thought about the Red King. If she shot Hammond, would both of them wink out of existence? Was the entire world Hammond's dream?

Of course not.

Lime fired. Hammond took the bullet, fell.

And the world winked out like a candle.

Around Lime, the lights went out. One by one, the lamps on the parking garage extinguished themselves. The faint shimmer coming through the skylight of the Alewife T station vanished. Lime lay on her back, breathing rapidly.

A familiar sound brought her back to reality. Her phone rang.

She fumbled through her pockets, found it. "Lime."

"Lime, it's Huang. Are you all right?"

"I'm not sure," she said, relieved to hear Huang's voice. "Did the world end?"

"What?"

"I'm lying here in darkness. I can't see a goddamned thing. I don't know what happened."

"I can explain. The electromagnetic waves that caused Hammond's psychokinesis were coming from the power grid, right? I called the power company and convinced them to shut off the city's power. You're in the middle of a blackout, that's all."

"How the hell did you convince them to turn the power off?"

"You don't want to know."

Lime laughed, then winced as she stood up, her muscles aching. She was bruised all over from her fall. "Did it work?" Huang asked

"I think so," Lime said, looking around. "I can't hear a thing. The psychic events seem to have ceased. And Hammond—" She broke off. "I don't know how Hammond is."

She looked up. Above her, there was no sound. No movement. No sign of anyone alive.

"Hammond?" Lime called.

Silence.

"Hammond?"

The elevator descended, then coasted to a gentle stop. The doors slid open as Lime stepped out into a windowless hallway. Reaching a security checkpoint, she flashed her ID at the guard, who nodded and buzzed her through the gate.

She passed several doors, then arrived at her destination. She knocked.

A muffled voice: "Come in."

Lime opened the door and went inside. Hammond sat up in a hospital bed, an IV tube in one arm, an electrocardiogram glowing green sawtoothed lines to his left. An open book lay on the coverlet.

"Hello," he said.

Lime pulled up a chair, sat down. "How are things?"

Hammond shrugged. "I'm all right, I suppose. I read, but I can't seem to write anymore. I don't know if I'll be able to write again." He paused for a moment. "So how does it look?"

"How does what look?"

"Well, am I going to jail?"

Lime weighed her response. "You have a number of felony counts against you. You may get some prison time, possibly a suspended sentence. But they've dropped the murder charge for lack of evidence."

"Good." Hammond looked at the four blank walls around him. "So how much longer do I have to stay here? Underground?"

"Not for long," Lime said. "That's what I came to tell you. The power company completed its tests today. As far as they can determine, all anomalous fields from the grid have ceased. It's safe for you to be outside again, for now."

"But what if it happens again?"

"I don't know." Lime looked away, unable to meet Hammond's eyes. "Have you had many visitors?" she finally asked.

"Not really. I've been expecting you, though."

"Why?"

Hammond smiled. "Given the way we parted company, I thought you might like to apologize."

Lime managed to smile back. She could see the bandages beneath Hammond's hospital gown. The bullet had passed through the left side of his chest, grazing the lung but doing no permanent damage. He had been lucky. If his organs had been arranged in the usual manner, with the heart on the left, the shot would have killed him outright. His situs inversus had saved his life.

Glancing around the room, Lime noticed that the mirror above the sink had been draped with a piece of cloth, hiding it from view.

Lime pointed to the mirror, turned back to Hammond. "Did you do that?"

"Yes," he said. "Can you blame me?"

"No," Lime admitted. "I can't." ■

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Look over all your copies of Analog dated 2003, or refer to the index on the following pages. Pick your three favorites in each of the following categories: novella, novelette, short story, science fact article, and cover. If you're not sure about a piece's category, you'll find it listed both in the Table of Contents for the issue in which it appeared, and in the Index. In the event of a disagreement between the Table of Contents and the Index, the Index should be considered correct. List your choices in order of preference (your favorite in each category is #1) on the ballot below, and either mail it in or send it by e-mail. You can also vote at our website, **www.analogsf.com**. The ballot is intended to make it easier for you to vote, but if you don't want to cut it out, feel free to copy it.

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2. ____________________
3. ____________________

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2003 Index

Here is the Index to 2003, Analog's Volume 123. Entries are arranged alphabetically by author, with month and page. When the author's name and/or part of the entry's title is omitted, it is the same as that of the previous entry. Multiple entries by the same author are listed alphabetically according to the story/article title. Collaborations are listed under all authors with cross references. Unless otherwise noted, each entry is identified as an Alternate View (av), editorial (ed), fact article (fa), guest editorial (ge), novella (na), novelette (nt), poem (pm), Probability Zero (pz), serial (ser), special feature (sf), or short story (ss).

Alexander, David—
  The Human Dress (nt) ... Mar 40
Asaro, Catherine—
  Walk in Silence (na) ... Apr 8

Benford, Gregory—
  The Power of Rotting Plants (fa) ... Oct 41
  (with Robert A. Metzger and Martin I. Hoffert)
Biggle, Jr., Lloyd—
  Of the Zornler, by the Zornler . . . (nt) ... Jun 10
  The Pristine Planet (ss) ... Mar 76
  The Problem of the Gourmet Planet (ss) ... Nov 42
Bodin, John C.—
  The Day the Track Stood Still (ss) ... May 70
  (with Ron Collins)
Bohnhoff, Maya Kaathryn—
  Distance (nt) ... Feb 110
Bova, Ben—
  Isaac Was Right (fa) ... Apr 40
  Sam and the Flying Dutchman (nt) ... Jun 114
Bratman, Steven—
  The Immortality Plague (nt) ... May 10
Brin, David—
  A Professor at Harvard (ss) ... Jul/Aug 136
Burns, Stephen L.—
  Capture Radius (nt) ... Feb 64
Burstein, Michael A.—
  Paying It Forward (nt) ... Sep 54

Chase, Robert R.—
  The Meeting of Pilgrims (nt) ... Jul/Aug 52
  Unseen (nt) ... Oct 62
Collins, Ron—
  The Day the Track Stood Still (ss) ... May 70
  (with John C. Bodin)
  Just Business (ss) ... Nov 52
Cooper, Brenda—
  Linda's Dragon (ss) ... Jul/Aug 170
  The Trellis (nt) ... Nov 8
  (with Larry Niven)
Cramer, John G.—
  The CERN LHC (av) ... May 66
  LSST—The Dark Matter Telescope (av) ... Jul/Aug 96
  A Mission to the Earth's Core (av) ... Dec 73
  The New Recycling Universe (av) ... Jan 80
  A Stroll Through the Lyman-Alpha Forest (av) ... Mar 69
  The Universe as Seen by WMAP (av) ... Oct 75

D'Ammassa, Don—
  A Good Offense (ss) ... May 80
  The Word Mill (pz) ... Jun 84

Easton, Tom—
  The Reference Library ... Jan 128
  ——— ... Feb 134
  ——— ... Mar 134
  ——— ... Apr 132
  ——— ... May 132
  ——— ... Jun 134
  ——— ... Jul/Aug 228
  ——— ... Sep 134
  ——— ... Oct 134
  ——— ... Nov 132
  ——— ... Dec 132

Flynn, Michael F.—
  Still Coming Ashore (nt) ... Jul/Aug 210
  3rd Corinthians (ss) ... Jun 73
Foss, Richard—
  Counterspy (pz) ... Jan 84
  Just an Average Guy (pz) ... Oct 80

Frederick, Carl—
  The Spacemice Incident (ss) ... Jul/Aug 154

The Study of Ants (ss) .... Sep 100

Gannon, Charles E.—
The Power of Visions (nt) .... Jun 42
Goulart, Ron—
The Robot Who Knew
Too Much (nt) .... Jul/Aug 73

Harness, Charles L.—
Faces (ss) .... Dec 59
Hatch, Daniel—
Seed of Destiny (na) .... Jan 8
Hemry, John G.—
Section Seven (ss) .... Sep 80
Hoffert, Martin I.—
The Power of Rotting Plants (fa) ... Oct 41
(with Robert A. Metzger and Gregory Benford)
Hoyt, Daniel M.—
Background Noise (ss) .... Jan 50
Hoyt, Sarah A.—
Traveling, Traveling (ss) .... Jul/Aug 86

Kennett, Shirley—
Agent (ss) .... Jul/Aug 163
Kirkland, Kyle—
Cult of the I (ss) .... Jan 64
Emma (ss) .... Apr 64
Personalized Drugs (fa) .... Jun 30
Windingweed (ss) .... Dec 78
Klein, Jay Kay—
BIOLOG: Kyle Kirkland .... Jun 40
Kondo, Yoji—
Kepler Mission (fa) .... Jan 42
Kooistra, Jeffery D.—
Isaac Was Wrong (Maybe) (av) .... Nov 66
LENR, Part I (av) .... Feb 96
LENR, Part II (av) .... Jun 80
Only on TV (av) .... Sep 67
Recent and Worthy (av) .... Apr 60

Landis, Geoffrey A.—
Cowzilla (pz) .... Jul/Aug 94
The Reason We're Here (sf) .... Dec 70
Latner, Alexis Glynn—
Trinity Bay (nt) .... Jul/Aug 194
Lee, Mary Soon—
Coming of Age (ss) .... Apr 74
Lerner, Edward M.—
By the Rules (nt) .... Jun 100
Moonstruck (ser)
(Part 1 of 4) .... Sep 8
(Part 2 of 4) .... Oct 92
(Part 3 of 4) .... Nov 96
(Part 4 of 4) .... Dec 90

Levites, Kevin—
Pale Horse (ss) .... Sep 75

The Rescue (pz) .... Nov 70
Lewis, Anthony—
Upcoming Events .... Jan 144
——— .... Feb 144
——— .... Mar 144
——— .... Apr 144
——— .... May 144
——— .... Jun 144
——— .... Jul/Aug 240
——— .... Sep 144
——— .... Oct 144
——— .... Nov 144
——— .... Dec 144
Lovett, Richard A.—
Brownian Motion (ss) .... Jul/Aug 145
Equalization (nt) .... Mar 10
From Salt Foam to
Artificial Oysters (fa) .... Jul/Aug 43
Moving Beyond "Life As
We Know It" (fa) .... Nov 30
Paleolakes, Jökulhlaups, and
Mobergs (fa) .... Feb 52
The Search for Extraterrestrial
Oceans (fa) .... May 36
Tiny Berries (nt) .... Sep 112

MacIntyre, F. Gwynplaine—
A Deadly Medley of Smedley (ss) ... Apr 47
Manison, Pete D.—
Punctuated Equilibrium (ss) .... Jun 86
The Watering Hole (ss) .... Sep 88
Who Names the Light? (nt) .... Nov 78
Melton, Henry—
Working Alone (ss) .... Jun 62
Metzger, Robert A.—
The Power of Rotting Plants (fa) ... Oct 41
(with Gregory Benford and Martin I. Hoffert)
Muller, Edward—
The First Lesson (ss) .... Sep 70

Niven, Larry—
The Death Addict (ss) .... May 60
The Ones Who Stay Home (ss) .... Jan 76
The Trellis (nt) .... Nov 8
(with Brenda Cooper)
Nordley, G. David—
The Fire and the Wind (nt) .... Jul/Aug 12

Oltion, Jerry—
The HASEG (pz) .... Feb 100
Oltion, Kathy—
Shoo Fly (ss) .... Nov 72

Plante, Brian—
Halloweentown (ss) .... Oct 82

continued on page 235

THE REFERENCE LIBRARY Tom Easton

Across the Nightingale Floor, Lian Hearn, Riverhead, $14, 305 pp. (1-57322-332-8).

Singularity Sky, Charles Stross, Ace, $23.95, 313 pp. (ISBN: 0-441-01072-5).

The Pixel Eye, Paul Levinson, TOR, $24.95, 336 pp. (ISBN: 0-765-30556-9).

Balance of Trade, Sharon Lee and Steve Miller, Embiid Publishing (www.embiid.net) (ISBN: 1-58787-216-1) and Meisha Merlin (ISBN: hb 1-59222-019-3; pb 1-59222-020-7), c. 400 pp., $?.

Surviving Frank, David A. Page, Five Star, $25.95, 273 pp. (ISBN: 0-7862-5634-6).

Flinx's Folly, Alan Dean Foster, Del Rey, $24.95, 266 pp. (ISBN: 0-345-45038-8).

Budayeen Nights, George Alec Effinger, Golden Gryphon, $24.95, 236 pp. (ISBN: 1-930846-19-3).

Space, Inc., Julie E. Czerneda, ed., DAW, $6.99, 320 pp. (ISBN: 0-7564-0147-X).

Promised the Moon: The Untold Story of the First Women in the Space Race, Stephanie Nolen, Four Walls Eight Windows, $22.95, 356 pp. (ISBN: 1-56858-275-7).

Analog is well known as a hard-SF magazine. But book publishers don't send me only hard SF. I also get a great deal of firm and even soft SF, as well as fantasy. I even review it.

And every so often I get something out of the ordinary, at least for *Analog*. The latest such is Lian Hearn's **Across the Nightingale Floor**, the first volume of the "Tales of the Otori" trilogy, to continue with *Grass for His Pillow* and *Brilliance of the Moon*. It's billed as an "International Bestseller," it carries some very laudatory blurbs, and even a cursory glance is enough to reveal that it is no sort of SF at all, and not even fantasy of the usual sort.

But I read it anyway, and I'm glad I did. The setting is an imaginary land closely modeled on Japan under its feudal warlords. Society is based on clans, and the region is dominated by the Tohan, led by the brutal Iida Sadamu. The Otori are a rival clan, defeated by the Tohan not long ago but still beloved by a great many people who recognize its more noble nature. Lurking in the shadows are two groups, the Hidden, who owe their allegiance to a god rather than any warlord, and the Tribe, assassins and spies with ninja-like skills. Few know of the Tribe. The Hidden, however, are meat for Tohan hunters, who one day come to the village of Mino.

Fifteen-year-old Tomasu returns from picking mushrooms to find the villagers—his stepfather, mother, sisters, all—slaughtered and a Tohan squad led by Iida himself covered in their blood. He flees, only to encounter Otori Shigeru, the banned heir to the Otori clandom. Soon he has a new name, Takeo, and he is being trained in the warrior arts by tutors who see in him the marks of the Tribe. His father, it seems, was an assassin of remarkable talent before he fled to the countryside.

In due time Shigeru adopts Takeo, and his Tribe talents emerge: he has preternatural hearing, he can cast off a shadow to distract attackers, he can be briefly invisible, and he can walk silently across a nightingale floor—built so that any weight at all makes it squeak. Since Iida is famous for having surrounded his quarters with such a floor, the future is clear.

Yet there are complications. Shigeru has a true love; he is sworn to marry no other, despite the politics that keep them apart. Iida knows of her too, and as soon as his ill wife dies, he uses his power to force her to marry him. At the same time, he arranges a marriage for Shigeru, though the young bride turns out to be powerfully attracted to Takeo (and vice versa). Tragedy looms, especially since Shigeru and Takeo see in all this unwanted match-making the perfect opportunity to get within striking distance of Iida.

Because this is the first volume of a trilogy, it takes no great perspicacity to see that Takeo must survive. Will anyone else? I won't say, but Hearn's writerly skills are immense. It may be hard to believe the Tribe's rather magical talents, but the scenery and the characters live, and the pacing is flawless. I do not hesitate to recommend *Across the Nightingale Floor* and its sequels to you.

According to Charles Stross, the next century will see the discovery of faster-than-light travel, nanotechnology will make the wildest dreams of the cornucopians come true, and humanity's computer networks will awaken to become the Eschaton, the closest approximation to God available in the real world. One of the first things the Eschaton does, after all, is to scatter humanity across hundred of worlds, willy-nilly, sorting them out according to ethnicity, politics, affinity, and what-have-you, and equipping them with universal-assembler cornucopias.

Sounds rather nifty, unless you're at the mercy of an economy that has just lost most of its workers and consumers, unless you start playing with time travel (the Eschaton stomps on you—HARD!—since it wants to protect its existence), or unless you wind up someplace like the New Republic, where the self-anointed elite have outlawed all modern tech (except for military), enslaved the peons, and built a very retro empire. That's the center of Stross's **Singularity Sky**, which opens as a strange phenomenon called the Festival arrives at one of the empire's more backward worlds, drops cell phones from the sky, and offers to fulfill anyone's wildest wishes if they can but provide information or entertainment.

The Revolution is on! And it doesn't take long for the New Republic to assemble an armada to deal with the problem, nor for it to figure a scheme that skates a mite close to the prohibition on time travel. Caught up in the mess is Martin Springfield, a stardrive engineer on assignment to upgrade the flagship. He's in trouble since he expressed heretical opinions about the New Republic in public, but they need him. He's off the hook, but perhaps not for long—a young secret policeman has been assigned to get the goods. It doesn't help that he has a secret agenda.

There's also the local UN rep, Rachel Mansour. Being a modern, independent woman who does not think she has but one function in life, she too is unpopular. She and Martin get cozy, and they both wind up on the expedition, even though they know it is doomed. The Festival is modern, you see, and the New Republic's retro jugheads don't stand a chance.

Stross mixes a pretty straightforward undercover adventure with a sly wit that pokes nasty fun at the retro mindset. It's a fun combination, and he's worth watching for on the stands.

In the past year or so, the Departments of Justice, Defense, Transportation, and Homeland Security have shown themselves to be more than a little surveillance-happy. The FBI has Carnivore (and more). The NSA has Echelon (and more). DOT has CAPPS II. DARPA's Total (now Terrorism) Information Awareness and Lifelog projects are just the latest. And anyone who objects on Fourth Amendment grounds is met with "If you haven't done anything wrong, you don't have anything to worry about." Idiots like that need to be reminded of the Reverend Martin Niemoller's famous poem (e.g., http://www.hoboes.com/html/FireBlade/Politics/niemoller.shtml). Or perhaps they should read Paul Levinson's latest Phil D'Amato romp, **The Pixel Eye**, which offers a new way for government agencies to spy on the citizenry.

The tale opens with D'Amato looking into reports of missing squirrels in the park. Soon he has heard of missing hamsters, too. Dead squirrels are turning up, poisoned with anaesthetics of the sort used in knock-out darts. So he visits a research lab and stumbles on some very strange technology: Since sensory input gets stored in the brain, it only made sense for someone to develop a method of reading it back out again. Add a bit of circuitry to remotely-control where a squirrel goes and what it watches or listens to . . . you get the idea. And of course there's nothing to limit the idea to squirrels. Think pigeons on the windowsill, watching your every move. Think your pet dog. Or the cat who has always been free to look at even the queen.

There's more than one lab, of course, even if each one doesn't seem to know what the others are doing and they all seem to blow up shortly after D'Amato visits. There's FBI agent Frank Catania, once a cop, who seems more than a little bit mysterious about what's going on. There are AI holograms who want to fill Phil in. There are mysterious explosions—which it turns out are caused by bombs carried inside squirrels and other critters.

Sheesh! They spy on you, and if they don't like what they see or hear; there's no nonsense about arrest, rights, or trials. Just KA-BOOM!

But there are critters involved that have nothing to do with federal research programs. Someone else is in the game, they know far too much, and the chief of Homeland Security is scheduled to give a speech in Central Park, surrounded by squirrels.

This one's nicely straightforward and an interesting take on the real world of the moment. My only cavil is that the business of reading sensory transcripts from the brain is both far-fetched and unnecessary when electronic memory is so compact and we're already talking about deploying networked smart dust (see, for instance, the June 2003 *Technology Review*). If you're putting in the squirrel brains electronics for control purposes, it would seem trivial to put in some electronic memory too, especially since wireless networking means the local storage capacity need not be huge.

On the other hand, Levinson's chosen approach means you can eavesdrop on what the critter heard or saw *before* you started with the add-ons. And at the end, he tosses our way an intriguing clue to what the next book might be about.

On the third hand, the electronic solution could probably be implemented in the very near future. I find that thought more than a little frightening.

Sharon Lee and Steve Miller continue to mine their Liaden Universe with **Balance of Trade**, a nice coming-of-age adventure. Instead of concentrating on wars of honor, they now look at the trader side of things, opening on a small family ship, the *Gobelyn's Market*. Young Jethri is on the verge of adulthood, but the captain, his mother, has spurned him ever since his father died. Now Mom has cut a deal to apprentice him to a different ship, and he is not happy.

Fortunately, he makes just the right moves when in dock and winds up with an offer to 'prentice with a Liaden Master Trader instead. This is unprecedented, but Jethri, we will learn, is a pretty special boy, only partly because of his interest in the odd little bits and pieces of old-time tech his father left him.

At any rate, off he goes into a very different world. He shows promise, makes a forbidden contact across old feud-barriers, confronts Liaden prejudice against the inferior Terrans, gets sent to the Master Trader's homeworld for polishing, and finally makes a mark.

The forbidden contact and the old tech turn out to be crucial, as does his parentage, which turns out to be rather different from what he had been raised to think. By the time all is clear, the reader is well and truly hooked for what looks like a very nice new series. The writing is as rich with detail as anything by C. J. Cherryh, while the general approach, as well as the old tech, reminds of Andre Norton.

We know Five Star for its recent spate of collections, a number of which I have mentioned here. Now it's getting into originals, and one of the first is David A. Page's **Surviving Frank**. The gimmick is a world where werewolves are real, caused by a virus. Frank, a Boston police detective, managed to get his infection treated *almost* in time—he doesn't turn into a wolf every full moon, but he's half wolf all the time. Tall, hairy—in fact, his friends call him Hairy—toothy, lapping his booze from a dog dish with his name on the side. He's got a temper, too, and his last dozen partners have all met untimely ends. You might not think losing one to a safe falling out of the sky would count against him, but Captain O'Leary wants to prove Frank is unfit to be one of Boston's finest. So he promotes Rookie Ryan to detective on condition that he will be partner thirteen and get the goods on Frankie.

Ryan isn't at all sure there any goods to get. As far as he knows, Frank is a good cop. But Wuffie doesn't want another partner—he's a lone wolf, of course—and Ryan feels he has to prove himself. Their first case is a murder in the city library. The Rookie spots a fresh clue or two and concludes that someone is plotting an assassination, but Frank pooh-poohs the idea. The quest for more clues introduces Ryan to a few fantastical elements of the city—such as the Trashcan People who inhabit the maze of medieval alleys behind the modern facade—as well as an enticing journalist who begins their relationship by exercising some impressive martial arts on his bod. That changes, of course, and in due time Ryan and Frank crack the case.

A fun tale, well worth a few hours of your time, but one thing did bother me: Page goes to some trouble to introduce a fantastical element—the werewolf—and insist that it wasn't fantastical at all. Just a virus, ma'am! Skiffy to the nines! But then he brings in definite fantastical elements (the Trashcan People are only one) that aren't really necessary; at least, they could easily have been replaced with non-fantastic equivalents. There is thus an uneasy mixing of genres. If Page can bring that under control, his next book should be worth a look.

Alan Dean Foster's new tale of Flinx and his toxin-spitting Alaspinian minidragon, **Flinx's Folly**, is the ninth in the popular series that began with *The Tar-Aiym Krang*. His origins were recounted in *For Love of Mother-Not* (reviewed here in Mid-September 1983): As an orphan, Flinx was auctioned as a sort of slave. Mother Mastiff, aged curio dealer in the low-life district of Drallar, main city of the planet Moth, bought him for unclear reasons. Love grew between them, and Flinx grew boldly streetwise. His empathic talent appeared, and one night a sense of lonely hunger drew him from his bed to an alley garbage heap, where he found the minidrag, Pip. The rest of that novel explained that before

Flinx reached his auction block, he had escaped from the Meliorare Society, a group of mad scientists who strove to use genetic engineering to improve the human species. They committed atrocities, were discovered, banned, and hunted. A few remained in hiding, seeking the best of their lost experiments. Now they had found Flinx, subject number twelve, and he must escape again. He succeeded, of course, for he had a distinct talent for adventure that in due time earned him the gift of a remarkable starship from illegal aliens. He also found that his unique talent made him sensitive to an inimical force rushing toward the galaxy from far, far away.

Folly opens with Flinx unconscious from one of his increasingly massive headaches, during which some thing or things seem to be telling him he is the key to stopping the onrushing doom. As soon as he sneaks out of the hospital—he can't risk close examination because of his gengineered differences—he is attacked by minions of a secret cult that does not want the doom stopped. So he hies off to New Riviera, where Clarity Held, one-time romantic interest, lives and works. Unfortunately, she is almost engaged to a man who soon decides he must get Flinx out of the way. Fortunately, Flinx's old friends and mentors the thranx Truzenzuzex and the human Bran Tse-Mallory arrive in the nick of time. Soon Flinx has a new frustration and a new mission firmly rooted in past adventures.

This is one of the longer-running series in modern SF, and with reason. Foster is a smooth writer who in much of his work seems glib and superficial. In this series, his weaknesses are much more under control. The series deserves its popularity.

The late George Alec Effinger earned considerable renown in his day (1947-2002), not least for his tales of Marid Audran, heir in training to great-grandpa Friedlander Bey, lord of crime and data. Marid, once just another bit of flotsam on the streets, has been raised to power and wealth and some involvement in his mentor's intrigues. Now he must survive the intrigues of the Budayeen, the low-life district of a future Arabian city. Drugs are easily available, strippers are rated on their "body-mods," and personalities, databases, and slices of others' lives can be plugged into one's brain rather like video game disks. Political and other schemes provide plenty of plot grist. I reviewed the three Budayeen novels here—*When Gravity Fails* in September 1987, *A Fire in the Sun* in January 1990, and *The Exile Kiss* in October 1991. There were also a number of short stories, of which four—including the unpublished "Marid Throws a Party"—appear in **Budayeen Nights**. One of the other three is the award-winning "Schrodinger's Kitten." There are five more tales as well, all memorable, and Barbara Hambly's introduction to tell you a bit about who George was.

I just handed in the manuscript for the fourth edition of my *Careers in Science* book, so it was with some interest that I spotted Julie E. Czerneda's **Space, Inc.**, in the mail. This is an anthology of fourteen original stories of future careers. Some of the tales, like James Alan Gardner's "Eightfold Career Path," are a bit tongue in cheek. Some, like Doranna Durgin's "Feef's House," are not. Sean P. Fodera deals with writing and publishing in "Attached Please Find My Novel." Nancy Kress sends an also-ran dancer into space to teach ballet to alien kids in "Dancing in the Dark."

By comparison, my own book is mundane and pedestrian and boring. Down-to-Earth, in other words.

Long before the Apollo program got off the ground, and well before the first Mercury astronauts—all men with test pilot backgrounds—thirteen women were accepted into astronaut training. They were pilots in an age when women needed a man's signature to buy a car or a home, when feminism had not yet been invented, when a woman in space could only be "ninety pounds of recreational equipment" (nyuk! nyuk!). Tough-minded and independent and as thoroughly enchanted with going into space as any man, they did fine in the tests. But NASA's pioneering fair-mindedness didn't last long. The woman-in-space program was suddenly and mysteriously canceled in 1961.

Why? You can read all about it in Stephanie Nolen's **Promised the Moon: The Untold Story of the First Women in the Space Race**. Nolen does a fine job of telling what it was like for women in those days, how difficult it was to do anything "manly," and how the frustrating tale worked out. She also sketches the history of women in aviation. All in all a fascinating look at a forgotten episode in space history, and just the sort of book to give any young woman who needs inspiring. ■

2003 Index

continued from page 229

Lavender in Love (ss) .... Feb 86
Plauger, P.J.—
  Lucky Luke (na) .... Dec 8

Read, Wolf—
  Between Singularities (ss) .... Feb 102
Resnick, Mike—
  Unsafe at Any Speed (sf) .... Mar 73
Rogers, Bruce Holland—
  Visions of Gingerbread (ss) .... Dec 67
Rollins, Grey—
  Not a Drop To Drink (nt) .... Jul/Aug 100

Scherrer, Robert—
  Born Under the Sign of
    Bonanza (ss) .... Nov 62
Schmidt, Stanley—
  Child, Village, and Bug (ed) .... Dec 4
  Driving Forces (ed) .... Jan 4
  Fitting Memorials (ed) .... Sep 4
  A Fragile Cornerstone (ed) .... Jul/Aug 4
  The Ground Floor (ed) .... May 4
  Missing the Point (ed) .... Nov 4
  The Return of the
    Mad Scientist (ed) .... Mar 4
  Scarce Skills and
    Scattered Substitutes (ed) ...... Oct 4
  Still Guessing, After All
    These Years (ed) .... Apr 4
  A Time To Be Wrong (ed) .... Jun 4
  Useful Illusions &
    Deadly Faith (ed) .... Feb 4
Shaffer, Catherine H.—
  If a Tree Falls . . . (fa) .... Dec 50
  You Can Change Your Genes (fa) . . . Sep 46

Solov, G.—
  The Atoms that I
    Breathe Today (pm) .... Mar 89
Strock, Ian Randal—
  Get Me To the Job On Time (pz) .... May 64

Tourtellotte, Shane—
  A New Man (nt) .... Oct 49
  Persistent Patterns (ss) .... Mar 58

Vajra, Rajnar—
  Afterburn (nt) .... Jan 86
  Shootout at the Nokai Corral (ser)
  (Part 1 of 4) .... Feb 8
  (Part 2 of 4) .... Mar 90
  (Part 3 of 4) .... Apr 84
  (Part 4 of 4) .... May 90
Vinge, Vernor—
  The Cookie Monster (na) .... Oct 8

Webster, Bud—
  Triumph in the Desert (nt) .... Jul/Aug 119
Whalen, Tressa—
  Bad Science, Bad
    Communication (fa) .... Mar 31
Wharton, Ken—
  Aloha (ss) .... Jun 92
  Mixed Signals (nt) .... Jan 100
  (with Lori Ann White)
  The Monopole Affair (nt) .... May 46
White, Lori Ann—
  Mixed Signals (nt) .... Jan 100
  (with Ken Wharton)

York, Pat—
  Home on the Range (ss) .... Jul/Aug 180

Dear Dr. Schmidt,

After I read the editorial and the Alternate View in the July/August issue, I chose to read "Not a Drop to Drink" by Grey Rollins. The title "jumped out at me" because, as a retired process engineer, I had been recording all I knew about water, including quoting The Ancient Mariner: "water, water, everywhere and not a drop to drink and all the boards do shrink." It was an interesting story, but I imagine you will receive a lot of comments about 1) *glass* water stills. In four years, a lot of corrosion resistant metal triple effect evaporators could be built. The Sun can supply the heat for the first effect, the first condenser is the reboiler for the second, and the last condenser is barometric. 2) Someone in the meetings should have suggested reverse osmosis. With their plant growing skills, growth of the required semipermeable membranes should have been easy.

A side comment on water: we all drink "heavy water" (deuterium oxide) that is used as a moderator in atomic energy plants and even a trace of radioactive tritium oxide, since both are present in *all* natural water sources!

From people with a different background, comments may arrive about making Agnes a rather unlikable character.

Alwien Dierl,
Long Beach, CA.

The author replies . . .

Once, when I was a child, I had a watch which proudly proclaimed that it was Water Resistant. I wore it to the pool one day and by the end of the afternoon it was nearly full of water. Lesson learned: There's a big difference between Water Resistant and Waterproof. The same lesson applies to metals and sea water. Corrosion resistant isn't corrosion proof, and chlorine just loves to combine with metals. Case in point, stainless steel. The chlorine present in ordinary table salt will pit stainless steel, eventually destroying it. The effect is most pronounced at a water-air boundary. Couldn't the metal be replaced? Of course. At tremendous expense.

Consider that metals require more energy (something not likely to be plentiful in a small offworld colony), more infrastructure, and more manpower than glass. I postulated about 750 colonists in the story. An average high school has . . . what . . . a thousand students? Now drop one in four students. That's not all that many people, really. Once you allow for having a butcher, a baker, and a candlestick maker, you're going to run out of workers very quickly. You can't just mine a corrosion resistant alloy—you have to mine each element separately, transport the ores, smelt them, combine them to make the alloy, form that into ingots or other usable forms, weld the metal . . . on and on and on. You've just used up every available person in the colony, not to mention the energy required for each step in the process. Glass, on the other hand, is much easier and cheaper to manufacture and work. When all is said and done, you're still faced with the fact that the colony is at high latitude and solar energy is limited.

Granted, given the difficulties I listed above, some authors would simply have used nanotechnology. Speaking personally, I've seen far too many stories where nanotechnology was used as a magic wand to solve otherwise intractable problems. I chose a different route.

As for reverse osmosis, the information I have on hand indicates that high pressures are required for the efficient desalination of sea water; on the order of 1500 psi. The next sentence rather dryly notes that membranes don't last long at those pressures. Again, you'll need corrosion resistant metals for the pumps, etc. My inclination is to pursue a design that requires less machinery and maintenance.

Agnes should have been a pleasant character? I must have missed something.

Dear Dr. Schmidt,

I think Richard Lovett [in his July/August fact article] has missed (at least partially) one possible sink—injection of CO_2 for tertiary recovery of natural gas and crude oil. At present a great deal of tertiary recovery involves injection of water—sometimes fossil saline produced from similar wells, and merely re-injected, but all too often fresh water, which then becomes fossil saline for all practical purposes, and which converts water into a non-renewable resource. Hydrocarbon liquids are also used sometimes, but there is a residual loss of fossil fuel in this process, requiring further injection. CO_2 injection has neither of these defects.

The geologic structures into which such CO_2 injections are put have been stable and non-leaking for millennia, although it is true that holes have been punched into them and other disruptions of the structure occur in developing the oil/gas field. However, the many thousands of capped wells in Alberta which would leak H_2S if they leaked, and which are carefully supervised, do not leak H_2S, so presumably CO_2 could be successfully and safely sequestered similarly. Why waste perfectly useful gas pressure?

I have no figures on the amount of CO_2 presently in use for this purpose, but several CO_2 pipelines are in operation, and most operators are looking for more sources of CO_2.

Also, I think too little is made of the volumes of produced carbonate that could be used. South Africa alone (for some reason this is the first site up when I Google "concrete-statistics"!) uses 10 million tons of concrete per year. EcoSmart offers statistics of 1 ton of concrete/person/year globally; for each tonne of cement produced, 1 tonne of CO_2 is produced. (The choice of units is theirs.) Turning CO_2 back into cement would reduce this amount drastically. It would also save mountains. Less than an hour from my home is the great "cement mountain" being sliced away by Canada Cement; it is horrifying to see the amount of mountain which has disappeared since I first saw it in 1967; this is one company, serving, basically, one province.

Then there is the astonishing demand for gravel. I sat, some years ago, on a committee to identify sites for protected areas which served biodiversity and had acceptable levels of impact for industry (Boy, was that fun!); every time we thought we had a good site, up would pop a municipality to say, "But what about our gravel pits?" I believe the demand for gravel to be insatiable and widely unappreciated, since gravel is not shipped long distances; statistics on internationally traded commodities are apt to grab more attention. Surely this produced carbonate could be persuaded to clump in such a way as to serve some of this market for gravel.

Thank you enormously for an article attempting to examine solutions; I wish I could give a copy to every energy minister in Canada.

Maryhelen Posey
Calgary, Alberta
Canada

The author replies . . .

Thank you for your thoughtful letter. I agree that using atmospheric CO_2 for tertiary recovery should be part of the solution. Currently, the CO_2 pipelines to which you refer draw on naturally sequestered CO_2 deposits in places like Wyoming and Utah. It's a no-brainer that we should quit drilling for CO_2 when we already have more than we want in the atmosphere.

At the December 2002 meeting of the American Geophysical Union, Michael A. Celia of Princeton University gave a progress report on efforts to model CO_2 leakage from deep injection into old oil and gas fields. He reported that there are nearly 200,000 wells in Alberta alone, of which about two-thirds are inactive. Some date back 100 years, raising questions about the quality of the capping and age-related degeneration of the concrete used to plug them. Also, a team in New Mexico is field-testing the injection of CO_2 into depleted wells—waiting to see if it geysers back to the surface in unexpected locations. The results of both of these studies, which I'll probably see at this fall's meeting (I'm writing this in August), will be very telling.

I like the idea of converting artificial carbonates to useful products, and I vaguely thought about this myself, too. It would be very nice, if it can be done. The biggest obstacle might be transportation. Quarrying is traditionally a local industry, and CO_2 sequestration, at least initially, will probably work best at centralized facilities built in conjunction with power plants.

Thanks again for the thoughtful letter.

Dear Dr Schmidt,

In reading Richard A Lovett's "From Salt Foam to Artificial Oysters" I was reminded of the adage: "You can't do one thing," and in his final few of paragraphs he makes a case for disposing of carbon by processing it to form calcium carbonate and (perhaps) dropping the product into deep ocean trenches to be eventually subducted and finally released through volcanoes "millions and millions of years" later.

He says that we need to get rid of twenty billion tons of carbon per year, and to do it we are going to need to add huge amounts of calcium. He doesn't mention the possibly of ninety billion tons of oxygen per year that are going to be going down the same plughole, and staying down there for those same "millions and millions of years."

It seems to me that it would be somewhat brighter to process the carbon dioxide and separate the C from the O, releasing the sixty billion tons of oxygen back into the atmosphere from whence it came. This would leave "only" twenty billion tons of finely powdered carbon which could be compacted to form chips or blocks and used to make concrete aggregate and/or construction blocks . . . or even toss them down the same plughole if no other use can be found!

John Dowdall
Perth Western Australia

The author replies . . .

Sadly, this idea runs afoul of the laws of thermodynamics. Basically, splitting the oxygen out of carbon dioxide is going to require energy—exactly as much energy as was released from burning the carbon in the first place, plus whatever inefficiencies exist in the process used to carry this out. It's basically a perpetual energy machine: burn coal for energy, then recreate coal from the gas. And if you could do this, why bury all of that carbon? You could just burn it all over again.

If the concern is about dropping all of that oxygen into an ocean trench and ultimately depleting the atmosphere's supply of oxygen, it pays to remember that compared to oxygen, carbon dioxide is a trace gas. And the oxygen is already removed by the process of burning the fuel. I'm not sure that burning the Earth's entire reserves of fossil fuel would make a notable dent in the atmosphere's supply of oxygen (it would be an interesting calculation)—but even if it did, the CO_2 would be a much bigger problem. ■

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UPCOMING EVENTS Anthony Lewis

12–14 December 2003

PHILCON 2003 (Philadelphia area SF conference) at Marriott City Center, Philadelphia, PA. Principal Speaker: Jack McDevitt. Artist Speakers: The Brothers Hildebrandt. Special Guests: Peter David and Harry Harrison. Registration: TBA. Info: Philcon, Post Office Box 126, Lansdowne, PA 19050-0126, registration@philcon.org, www.philcon.org.

2–4 January 2004

SHADOWCON VIII (Horror, gaming, etc. conference) at Days Inn Hotel, Memphis TN. Pro Guest of Honor: P.N. Elrod, Fan Guest of Honor: Melanie Simmonds. Membership: $25 until 6 December 2003, $27 at door. Info: Shadow Con VIII, 5310 Hungerford Rd., Memphis TN 38118; Kanellissa@aol.com; www. shadowcon.org.

9–11 January 2004

DARKCON 2004: CONVERGENCE (Fantasy-oriented gaming conference) at Embassy Suites Phoenix North, Phoenix AZ. Registration: $20. Info: DarkCon 2004, Box 82575, Phoenix AZ 85071; (623)435-9700; darkcon@darkOnes.org; www.darkcon.org.

23–25 January 2004

MARS-CON 2004 (SF/gaming/anime conference) at Clarion Hotel, Williamsburg VA. Registration: $20 until 1 January 2004, $30 at the door (checks to MarsCon, c/o R. Snare, 117 Wichita Ln., Williamsburg VA 23188). Info: MarsCon, c/o Bob Snare, Box 8143, Yorktown VA 23693; info@marscon.net; www.marscon.net.

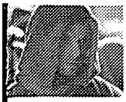
13–15 February 2004

BOSKONE 41 (New England Regional SF Conference) at the Sheraton Boston Hotel, Boston MA. Guest of Honor: Stephen Baxter. Official Artist: Richard Hescox. Special Guest: Betsy Mitchell. Featured Filkers: Bill & Brenda Sutton. Registration: $41 until 10 January 2004, more thereafter and at the door. Info: Boskone 41, Box 809, Framingham MA 01701; fax: (617)776-3243; info@boskone.org; www.nesfa.org/boskone.

2–6 September 2004

NOREASCON 4 (62nd World Science Fiction Convention) at Sheraton Boston, Marriott, and Hynes Convention Center, Boston, MA. Guests of Honor: William Tenn, Terry Prachett, Jack Speer, Peter Weston. Registration until 30 September 2003: Attending USD160, Supporting USD35, Child USD105. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Info: Noreascon 4, Post Office Box 1010, Framingham, MA 01701. FAX: (617)776-3243. info@noreascon.org; www.noreascon4.org.

Attending a convention? When calling conventions for information, do not call collect and do not call too late in the evening. It is best to include a S.A.S.E. when requesting information; include an International Reply Coupon if the convention is in a different country. ■



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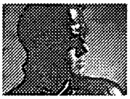

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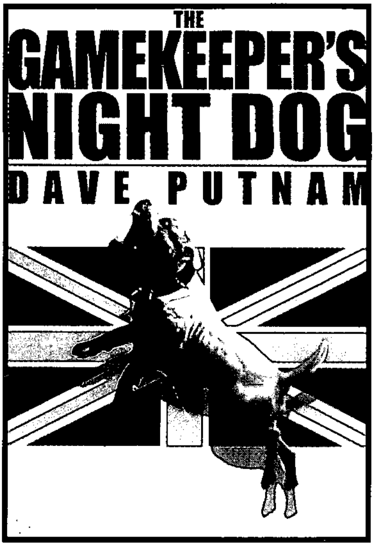

The Gamekeeper's Night Dog is an alternate history novel that takes the reader to the last decade of the 19th century and into a Britain preparing to fight the Boer War. As this alternate universe moves away from ours, military technology diverges at a geometric pace. The alternate British Army rediscovers her ancient penchant for fighting with huge packs of savage war dogs garbed in battle harnesses. The machinegun is not treated as an experimental curiosity, but embraced as the lynchpin of the Queen's new fast attack doctrine. Armored war trains are packed with weapons to the point where they begin to resemble land going battle ships. Instead of a Vietnam type quagmire, Britain launches a desert storm into the killing fields of South Africa.

Man and his culture are created by technology. Change technology and you not only change history, you change man. The Gamekeeper's Night Dog is the first book in a trilogy that seeks to forge a new kind of science fiction: a genre that roots an alternate future into a rich tapestry of alternate history.

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